CAIS STANDARD MANUAL

SYSTEM NO. 21
WATERFRONT

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SUBJECT: Transmision of Technical Documents

1. As per telephone conversation with Andrew Poulis, EQ/TIC, the attached CAIS CTDS manuals are forwarded for accession, cataloging, and microconversions. Please forward the accession numbers to:

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3. If you have questions about these documents, please contact Andrew Poulis at DSN 523-6285.

Larry L. Testerman
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Atchs: Manuals

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ABSTRACT

GENERAL ORGANIZATION

At this installation the list of facilities to be surveyed will be addressed on the basis of 32 unique systems that form the CAIS Engineering Deficiency Standards and Inspection Methods document. Each system deals with a specific technical aspect of the facility to be surveyed. Within each system a further breakdown is made to subsystems, each having a specific list of components. Specific observations of the listed defects are provided so as to allow the entry of observed quantification data. A DOD CAIS manual is provided for each of the 32 systems with an internal organization as outlined below:

INSPECTOR'S GUIDE

I. General
   - A. Level I Inspection Method Description
   - B. Level II Inspection Method Description
   - C. Level III Inspection Method Description

II. General Inspection
   - A. Process. This section describes the process of the inspection activity.
   - B. Location. This section describes the procedure for locating the inspection units in the facility or infrastructure on this installation.

III. Inspector Qualifications

This section notes the minimum qualifications for the person or persons performing the survey.

IV. Inspection Unit

This section describes how the IU (Inspection Unit) is determined for the particular component being surveyed.

V. Unit Costs

This section notes the nature of repair costs for this system.

VI. Standard Safety Requirements

This section lists safety procedures and equipment required to implement a safe environment for the conduct of this survey.

VII. Standard Tools

This section lists a set of standard tools required for the general conduct of this survey.

VIII. Special Tools and Equipment Requirements

This section refers to special tools or equipment requirements endemic to the nature of the system being surveyed.

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IX. Level II Inspection Method Keys

This section explains the use of keys as they relate to Level II Guide Sheets.

X. Level III Inspection Method Keys

This section explains the use of keys as they relate to Level III Guide Sheets.

XI. Replacement Cost

This section describes the nature and location of replacement cost data.

XII. Appendices

Appendix A. Provides a listing and definition of all abbreviations used both in the Standards and in the data base.

Appendix B. Provides a glossary of terms with their definitions as used in the Standard.

Appendix C. This section contains a listing of the average life cycle durations for each assembly* in the Standard.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

SYSTEM TREE

The System Tree is a graphical representation of the Work Breakdown Structure, showing system, subsystem and component relationships for the Waterfront System.

INSPECTION METHODS

Description

Describes the nature of what is to be condition surveyed.

Special Tool and Equipment Requirements

Lists any special tools required for this specific subsystem.

Special Safety Requirements

This section outlines any special safety measures or equipment required for this specific subsystem so as to maintain a safe environment and process in the conduct of the condition survey.

Component List

All components to be surveyed under this subsystem are listed here.

Related Subsystems

All other subsystems that have a survey relationship to this subsystem are listed here to help coordinate a complete and thorough condition assessment survey.

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Standard Inspection Procedure

This statement indicates the various levels of survey effort required for this subsystem.

Components

The previously listed components of this subsystem are described with a survey procedure recommended on a component by component basis. For each component there is a listing of defects with each defect broken down into observations describing the nature and severity of the defective condition observed. The surveyor enters a quantification value for each defect/observation encountered in the field CAIS device (DCD) to record the result of his survey.

References

This page lists the reference sources from which the foregoing subsystem data was developed.

Guide Sheet Control Number

This section lists the key numbers that tie the written Level II and Level III guide sheets to specific components in this subsystem.

Level II and Level III Inspection Method Guide Sheets

This section contains the detailed descriptions of the Level II and III survey and inspection procedures for this subsystem.

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INSPECTOR'S GUIDE

I. GENERAL

A. Level I Inspection Method

The Level I Inspection Method of waterfront systems consists of a thorough inspection of each subsystem and component as described in the Work Breakdown Structure. Only readily accessible components need to be addressed during a Level I inspection. The survey activity is designed to be performed by a single surveyor.

B. Level II Inspection Method

Level II inspections are triggered by defect/observations noted at the Level I inspection or in some cases, are required to conduct a meaningful survey of the component being inspected. The Waterfront inspection requires very few Level II inspection methods, since most defects above water are readily apparent from a Level I inspection. Wood construction may require additional cleaning and probing to determine the quantity and level of severity of defects identified in Level I. Metal cracks and welds may require dye penetration testing to determine the extent and size of cracks identified in the Level I.

The Level II effort <u>underwater</u> is directed toward detecting and identifying damaged/deteriorated areas which may be hidden by surface biofouling or deterioration and toward obtaining a limited amount of deterioration measurements. Level II inspections will often require cleaning of structural elements. Since cleaning is time consuming, it is generally restricted to areas that are representative of the entire structure and areas of apparent distress as determined by the Level I inspection. Simple instruments such as calipers and measuring scales are commonly used to take physical measurements. Subjective judgements of structural integrity are occasionally made by probing wood with ice picks and by sounding concrete and steel with hammers.

C. Level III Inspection Method

The Level III inspection is triggered by defect/observations occurring in the Level I and II inspections. The Level III inspection can also occur as a result of time based scheduling, antidotal experience, or component age compared to its life cycle. The Level III inspection is referenced through a Level III key which in turn, denotes a specific Guide Sheet describing the Level III inspection process and requirements. Level III inspections produce a detailed, written engineering assessment of the deficiency along with an estimated cost of correction, and are performed at the option of the Facility Manager.

For the Waterfront System, defect data from Level I inspection may indicate the possibility of hidden damage, which requires further investigation and testing to formulate a repair strategy. The Level III inspections involve more extensive testing, including the use of Non-Destructive Testing (NDT), such as ultrasonic pulse velocity

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testing and half-cell potential testing, as well as partially destructive testing, such as core sampling, physical material sampling or in situ surface hardness testing, in order to determine the extent of the suspected damage.

The Level III effort underwater is a highly detailed and thorough investigation to detect the full extent of hidden or interior damage, internal voids, and the loss of cross-sectional area. A Level III effort usually requires very careful cleaning. Level III often requires the use of NDT techniques, such as ultrasonic pulse velocity testing, but may also require the use of partially destructive techniques such as core sampling, physical material sampling, or in situ surface hardness testing. The use of NDT techniques are generally limited to key structural areas, areas that may be suspect, or to structural members which may be representative of the overall underwater structure.

II. GENERAL INSPECTION

A. Process

Surveys are normally conducted at the component level. Figure 21-A provides the breakdown from system through component for the Waterfront System. The surveyor will work through the Work Breakdown Structure (WBS) to conduct the inspection. At the component level the surveyor will be provided a list of defects, each of which is described further in detail as observations. These observations are described to various levels of severity as they relate to the effect of the life of the system. The quantification of each deficiency is identified by the surveyor using the associated unit of measure. Once an observation is populated with a deficient quantity, the inspector will be requested to provide information on the component type and location. The installation date or age of the component may be preloaded into the WBS for each asset from the Real Property Inventory List or site specific information. If necessary, age data can be overridden by the surveyor, Site CAIS personnel, or the Facility Manager.

B. Location

Level I and II inspections will be located by the surveyor through a discrete entry in the Field CAIS. Plans, sketches and/or maps are required to ensure a complete inspection of all areas and to assist in the location of IU's. The inspection team members must use the recommended numbering schemes for the installation. The installation may have areas physically identified by a numbering system or identified on the plans. If both exist and are different, the Facility Manager will develop guidance on which numbering system takes precedence. Where numbering systems do not exist or are not complete in identifying each area, specific guidance for the inspector to annotate areas in a consistent manner should be developed by the Facility Manager and implemented in the installations CAS process. In all cases, plans and maps shall be orientated with the top of each sheet being the north direction, so as to allow directional location and description. In the case where no other means of location exist the inspector shall enter a brief (65 character) description of location. Locations must be accurate to insure future repeatability and consistent results.

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III. INSPECTOR QUALIFICATIONS

Inspection of waterfront facilities involves the application of special skills, equipment and techniques to examine underwater structures. The inspection requirements are similar to those for other structures, but the methods differ considerably. The basic underwater inspection shall include a "swim-by" of all components of a facility and detailed examination of a sample of components that are representative of the entire structure.

The minimum inspector qualification for the Waterfront System requires a five year journeyman. Inspectors will be specifically trained in the CAS system and its usage and will be CAS certified in the "Civil", "Electrical" and "Mechanical" disciplines.

The underwater inspection should be accomplished by qualified divers. All A&E divers shall be:

- Trained and certified for scuba diving and surface air.
- Skilled in the use of state-of-the-art inspection equipment, including a broad range of viewing, cleaning, and measuring equipment.

At least one of the divers on the inspection team should be a Registered Professional Engineer. The P.E. should be diving on site for at least 50% of the field inspection.

All military divers and government civilian divers participating in underwater inspections shall be graduates of Navy dive schools and certified by the Navy for SCUBA diving.

IV. INSPECTION UNIT (IU)

The Inspection Unit (IU) is normally defined at the component level for this system. The varied configurations of the components that exist in the Waterfront System require that they be evaluated differently when defining the IU. Therefore, the measurement technique requires some consideration. If the inspector finds multiple defects that occur on the same IU, the inspector will quantify the observation that is considered most severe and identify the remaining quantity under the less severe observation for the discrete component. The following are some guidelines for establishing IU's for components in the Waterfront System:

- The following components come in standard sizes (defined in component type selections) and have IU's that are defined as one **each**:
    - Wedge blocks, chocks and bolts
    - Floating crib camels and separators
    - Floating deep/shallow camels and separators
    - Floating fenders
    - Fixed directly mounted fender units

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- Tie rods, long bolts
- Deck drains, scuppers and drainage slots
- Manhole covers
- Marine hardware
- Flotation tanks/buoyancy chambers
- Floating pier fittings
- Floating pier chain anchorage systems
- Capstan assembly
- Keel and bilge blocks
- Cradle wheels
- Chain pulls
- Boot jacks
- Docking assembly mounting framework
- Docking winch assembly
- Walkway draft gauges
- Hauling system

• The following components are vertical wall-type structures of variable length and width, that have IU's that are measured in **square feet.** If large areas exist, IU's should be broken down into manageable sections, using logical breaking points when possible (i.e., expansion joints, directional changes in the plane of the wall, etc.).

- Sheet piling
- Bulkheads
- Retaining walls
- Firewall partitions
- Bearing panels
- Fixed hung fender systems
- Closure walls
- Caissons
- Sluice gates

• The following components are horizontal floor-type structures of variable length and width, that have IU's that are measured in **square feet.** If large areas exist, IU's should be broken down into manageable sections, using logical breaking points when possible (i.e., control joints, expansion joints, etc.).

- Deck or floor surfaces
- Catwalks
- Floating pier access ramps
- Stairs (IU is defined as a flight of stairs, measured horizontally, not vertically.)
- Pile caps
- Collector channel/flooding culvert grating
- Coping (may include a vertical coping wall)
- Groundways

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- Chain paths and guides
- Cradles
- Cradle roller trains

- The following components are sloped irregular-shaped structures. The IU is defined as the **square feet** of surface area covered by the base of the structure.

  - Riprap
  - Rock dikes
  - Rubble-mound structures
  - Semipermeable type groins
  - Harbor bottom (The IU is defined as the square footage of earth material surface under the body of water immediately adjacent to the wharf, pier, quaywall, etc.)

- The following components are long slender structures having standard widths or diameters (defined in component type selection) and variable lengths, and have IU's that are measured in **linear feet.**

  - Piles
  - Floating single and built-up log camels
  - Bracing, wales, chocks
  - Handrails and guardrails (When the adjacent deck, catwalk, stairs or ramp are divided as separate IU's, the railing should use the same separation points.)
  - Removable chain railings (IU is defined as the linear feet of continuous length of chain, to include stanchions between ends.)
  - Ladders (IU is defined as a continuous length.)
  - Deck curbing
  - Structural frame members (length of member)
  - Walkway framing (IU is defined as the length of the framing, defined by joints or directional changes in the plane of the surface. When the adjacent decking is divided as separate IU's, the framing should use the same separation points.)
  - Cradle tracks
  - Fenders/chafing strips
  - Chafing strips, bands and wraps
  - Walkway fenders and fittings
  - Cradle track supports
  - Cables and cable connectors

V. UNIT COSTS

The unit costs that are applied to the quantities recorded for each observation are contained within the Site CAIS as repair cost.

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VI. STANDARD SAFETY REQUIREMENTS

The Master Safety Plan will be followed at all times during the condition survey.

Inspector may utilize the following protective gear:
- Hard hat - to be worn during all surveys
- Safety glasses - to be worn during all surveys
- Safety shoes - to be worn during all surveys
- Coveralls - to be worn as necessary
- Gloves - to be worn as necessary
- Ear plugs - to be worn in designated areas
- Knee pads - to be worn when crawling is required
- Rain suit - to be worn as necessary
- Wet suit - to be worn as necessary

VII. STANDARD TOOLS

The following list of standard tools and equipment are required to perform the inspection of waterfront structures:

Employee Identification Card - to be worn or carried during all survey activities
Data Collection Device (DCD)
Battery pack for DCD
Tape measure - 20' (or other supplemental measuring devices)
Screwdrivers - Phillips and straight slot
Pocket knife or ice pick
Scraper
Wire brush
Chipping hammer or chisel
Calipers
Depth gauge
Measuring scales
Binoculars
Dye, paintbrush, developer and rags
Ladder (when required)

The following additional equipment is required to perform the inspection of the underside portion of waterfront structures:

- Small boat or raft

The following additional tools and equipment are required to perform the underwater inspection of waterfront structures:

- Scuba diving equipment (for underwater inspections conducted by scuba divers)
  - Exposure suit
  - Scuba regulator and tank

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   - Face mask
   - Buoyancy compensator
   - Weight belt
   - Swim fins
   - Diving knife
   - Diver's wristwatch or bottom-timer
   - Diving depth gauge
   - Submersible pressure gauge
   - Dive light
   - Communication equipment (preferably wireless)
- Surface-supplied diving equipment (for underwater inspections conducted by surface-supplied divers)
   - Exposure suit
   - Weight belt
   - Swim fins or boots
   - Diving knife
   - Safety harness
   - Breathing apparatus, outfitted with two-way communication and dive light
- Plexiglass slate and grease pencil
- Underwater camera or underwater video equipment, if desired
   - Plexiglass clear water box (for improved quality of photographs in turbid water)
- Power cleaning tools (for more efficient cleaning of large areas, if required, to perform Level II inspections)
   - Hydraulic rotary brushes
   - Grinders and scrapers
   - High pressure water jets
   - Cavitation erosion jets

VIII. SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

At the subsystem level, the deficiency standard has identified special tools and equipment required for the standard inspection of the associated components, which exceed the standard tools identified for the system. Level III Inspection Method Guide Sheets will address additional tools and equipment requirements that are specific to that particular advanced method of inspection.

Facility Managers should review these sections in order to determine any special tool requirements for subsystems they are to inspect/survey.

IX. LEVEL II INSPECTION METHOD KEYS

Certain observations will reference a Level II Inspection Method. The Facility Manager will be able to identify deficiencies where a Level II inspection is flagged. The Level II key at the observation level will refer to a specific guide sheet.

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All Level II Guide Sheets are located at the end of each Subsystem section. A Guide Sheet Reference page precedes Level II and Level III Guide Sheets.

X. LEVEL III INSPECTION METHOD KEYS

Certain observations will trigger a Level III inspection. The Facility Manager will be able to identify deficiencies where a Level III inspection is flagged. The Level III Key at the observation level will refer to a specific guide sheet. These guide sheets may refer the Facility Manager to a more sophisticated and costly test method.

All Level III Guide Sheets are located at the end of each Subsystem section. A Guide Sheet Reference page precedes Level II and Level III Guide Sheets.

XI. REPLACEMENT COST

A replacement cost for each subsystem type will be contained within the cost estimating system in the Site CAIS.

XII. APPENDICES

Appendix A - Abbreviations

A summary and definition of all abbreviations used in this system are contained in Appendix A which is located at the end of Waterfront.

Appendix B - Glossary

A glossary of terms used in this system are contained in Appendix B which is located at the end of Waterfront.

Appendix C - Life Cycles

A listing of the average life cycle duration for each assembly* in the Standard.

Note - Facility Manager's Guide

The following are included in the Facility Manager's Guide:

A table the required manhours to perform the standard inspection for this facility listed by Cat Code (three digit).

A listing of all Level III inspections with their estimated cost and time to perform. This list will include frequency of inspection for time driven Level III's.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

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Figure 21-A. WORK BREAKDOWN STRUCTURE

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT	21.01 Dolphins	21.01.01 Piles - Wood
		21.01.02 Cables/Cable Connections
		21.01.03 Wedge Blocks, Chocks and Bolts
		21.01.04 Chafing Strips/ Bands
	21.02 Wharves	21.02.01 Piles - Wood
		21.02.02 Piles - Concrete
		21.02.03 Piles - Metal
		21.02.04 Pile Caps - Wood
		21.02.05 Pile Caps - Concrete
		21.02.06 Pile Caps - Metal
		21.02.07 Bracing - Wood
		21.02.08 Bracing - Metal
		21.02.09 Deck Surfaces - Wood
		21.02.10 Deck Surfaces - Concrete
		21.02.11 Deck Surfaces - Metal
		21.02.12 Handrails / Guardrails - Wood
		21.02.13 Handrails / Guardrails - Concrete
		21.02.14 Handrails / Guardrails - Metal
		21.02.15 Catwalks - Wood
		21.02.16 Catwalks - Metal
		21.02.17 Ladders - Wood
		21.02.18 Ladders - Metal
		21.02.19 Deck Curbing - Wood
		21.02.20 Deck Curbing - Concrete
		21.02.21 Deck Curbing - Metal
		21.02.22 Deck Scuppers and Drainage Slots - Concrete
		21.02.23 Deck Drains, Scuppers and Drainage Slots - Metal
		21.02.24 Manhole Covers - Metal
		21.02.25 Marine Hardware - Metal
		21.02.26 Firewall Partitions - Wood
		21.02.27 Firewall Partitions - Concrete
		21.02.28 Firewall Partitions - Metal
		21.02.29 Structural Frame Members - Wood
		21.02.30 Structural Frame Members - Concrete
		21.02.31 Structural Frame Members - Metal
		21.02.32 Riprap
		21.02.33 Harbor Bottom

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Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT (Continued)	21.03 Piers	21.03.01 Piles - Wood
		21.03.02 Piles - Concrete
		21.03.03 Piles - Metal
		21.03.04 Pile Caps - Wood
		21.03.05 Pile Caps - Concrete
		21.03.06 Pile Caps - Metal
		21.03.07 Bulkheads - Wood
		21.03.08 Bulkheads - Concrete
		21.03.09 Bulkheads - Metal
		21.03.10 Bulkheads - Stone Masonry
		21.03.11 Piling/Bulkhead Tie Rods, Long Bolts - Metal
		21.03.12 Piling/Bulkhead Bracing, Wales, Chocks - Wood
		21.03.13 Piling/Bulkhead Bracing, Wales, Chocks - Metal
		21.03.14 Deck Surfaces - Wood
		21.03.15 Deck Surfaces - Concrete
		21.03.16 Deck Surfaces - Metal
		21.03.17 Handrails/Guardrails - Wood
		21.03.18 Handrails/Guardrails - Concrete
		21.03.19 Handrails/Guardrails - Metal
		21.03.20 Catwalks - Wood
		21.03.21 Catwalks - Metal
		21.03.22 Ladders - Wood
		21.03.23 Ladders - Metal
		21.03.24 Deck Curbing - Wood
		21.03.25 Deck Curbing - Concrete
		21.03.26 Deck Curbing - Metal
		21.03.27 Deck Scuppers and Drainage Slots - Concrete
		21.03.28 Deck Drains, Scuppers and Drainage Slots - Metal
		21.03.29 Manhole Covers - Metal
		21.03.30 Marine Hardware - Metal
		21.03.31 Firewall Partitions - Wood
		21.03.32 Firewall Partitions - Concrete
		21.03.33 Firewall Partitions - Metal
		21.03.34 Structural Frame Members - Wood

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Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT (Continued)	21.03 Piers (Continued)	21.03.35 Structural Frame Members - Concrete
		21.03.36 Structural Frame Members - Metal
		21.03.37 Rock Dikes
		21.03.38 Riprap
		21.03.39 Harbor Bottom
		21.03.40 Rubble-Mound Structures
		21.03.41 Retaining Walls - Concrete
		21.03.42 Floatation Tanks/Buoyancy Chambers - Metal
		21.03.43 Floatation Tanks/Buoyancy Chambers - Concrete
		21.03.44 Floating Pier Fittings - Metal
		21.03.45 Floating Pier Chain Anchorage Systems - Metal
		21.03.46 Floating Pier Access Ramps - Wood
		21.03.47 Floating Pier Access Ramps - Concrete
		21.03.48 Floating Pier Access Ramps - Metal
	21.04 Graving Docks	21.04.01 Closure Walls - Concrete
		21.04.02 Closure Walls - Stone Masonry (Cyclopean Walls)
		21.04.03 Deck/Floor Surfaces - Concrete
		21.04.04 Caissons
		21.04.05 Sluice Gates
		21.04.06 Fenders/Chafing Strips
		21.04.07 Stair Structure - Concrete
		21.04.08 Stair Structure - Metal
		21.04.09 Ladders - Metal
		21.04.10 Catwalks/Platforms - Metal
		21.04.11 Coping - Concrete/Granite
		21.04.12 Removable Chain Railings
		21.04.13 Collector Channel/Flooding Culvert Grating
		21.04.14 Handrails/Guardrails - Metal
		21.04.15 Manhole Covers - Metal
		21.04.16 Marine Hardware - Metal
		21.04.17 Capstan Assembly
		21.04.18 Keel and Bilge Blocks

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Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM / **SUB-SYSTEM** / **COMPONENT**

- 21 WATERFRONT (Continued)
  - 21.05 Marine Railways
    - 21.05.01 Groundways - Reinforced Concrete
    - 21.05.02 Chain Paths and Guides
    - 21.05.03 Cradle Tracks
    - 21.05.04 Cradle Track Supports - Wood
    - 21.05.05 Cradle Track Supports - Concrete
    - 21.05.06 Cradle Track Supports - Metal
    - 21.05.07 Cradles
    - 21.05.08 Cradle Wheels
    - 21.05.09 Cradle Roller Trains
    - 21.05.10 Chain Pulls
    - 21.05.11 Keel and Bilge Blocks
    - 21.05.12 Boot Jacks
    - 21.05.13 Docking Assembly Mounting Framework - Wood
    - 21.05.14 Docking Assembly Mounting Framework - Metal
    - 21.05.15 Docking Winch Assembly
    - 21.05.16 Walkway Framing - Wood
    - 21.05.17 Walkway Framing - Metal
    - 21.05.18 Walkway Decking
    - 21.05.19 Handrails/Guardrails - Wood
    - 21.05.20 Handrails/Guardrails - Metal
    - 21.05.21 Walkway Ladders - Wood
    - 21.05.22 Walkway Ladders - Metal
    - 21.05.23 Walkway Draft Gauges - Wood
    - 21.05.24 Walkway Draft Gauges - Metal
    - 21.05.25 Walkway Fenders and Fittings
    - 21.05.26 Hauling System
  - 21.06 Quaywalls
    - 21.06.01 Piles - Wood
    - 21.06.02 Piles - Concrete
    - 21.06.03 Piles - Metal
    - 21.06.04 Pile Caps - Wood
    - 21.06.05 Pile Caps - Concrete
    - 21.06.06 Pile Caps - Metal
    - 21.06.07 Bulkheads - Wood
    - 21.06.08 Bulkheads - Concrete
    - 21.06.09 Bulkheads - Metal
    - 21.06.10 Bulkheads - Stone Masonry (Cyclopean Walls)

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Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT (Continued)	21.06 Quaywalls (Continued)	21.06.11 Piling/Bulkhead Tie Rods, Long Bolts - Metal
		21.06.12 Piling/Bulkhead Bracing, Wales, Chocks - Wood
		21.06.13 Piling/Bulkhead Bracing, Wales, Chocks - Metal
		21.06.14 Deck Surfaces - Wood
		21.06.15 Deck Surfaces - Concrete
		21.06.16 Deck Surfaces - Metal
		21.06.17 Handrails/Guardrails - Wood
		21.06.18 Handrails/Guardrails - Concrete
		21.06.19 Handrails/Guardrails - Metal
		21.06.20 Catwalks - Wood
		21.06.21 Catwalks - Metal
		21.06.22 Ladders - Wood
		21.06.23 Ladders - Metal
		21.06.24 Deck Curbing - Wood
		21.06.25 Deck Curbing - Concrete
		21.06.26 Deck Curbing - Metal
		21.06.27 Deck Scuppers and Drainage Slots - Concrete
		21.06.28 Deck Drains, Scuppers and Drainage Slots - Metal
		21.06.29 Manhole Covers - Metal
		21.06.30 Marine Hardware - Metal
		21.06.31 Firewall Partitions - Wood
		21.06.32 Firewall Partitions - Concrete
		21.06.33 Firewall Partitions - Metal
		21.06.34 Structural Frame Members - Wood
		21.06.35 Structural Frame Members - Concrete
		21.06.36 Structural Frame Members - Metal
		21.06.37 Rock Dikes
		21.06.38 Riprap
		21.06.39 Harbor Bottom

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Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT (Continued)	21.07 Jetties	21.07.01 Piles - Sheet Steel
		21.07.02 Wales - Metal
		21.07.03 Tie Rods, Long Bolts - Metal
		21.07.04 Rubble-Mound Structures
		21.07.05 Harbor Bottom
	21.08 Breakwaters	21.08.01 Rubble-Mound Structures
		21.08.02 Harbor Bottoms
	21.09 Groins	21.09.01 Piles - Wood
		21.09.02 Piles - Concrete
		21.09.03 Piles - Sheet Steel
		21.09.04 Piles - Wood Sheet and Wales
		21.09.05 Semipermeable Type Groins
		21.09.06 Harbor Bottom
	21.10 Seawalls	21.10.01 Walls - Concrete
		21.10.02 Decks - Concrete
		21.10.03 Scuppers and Drains
		21.10.04 Curbs - Concrete
		21.10.05 Handrails/Guardrails - Metal
		21.10.06 Handrails/Guardrails - Wood
		21.10.07 Rubble/Riprap
		21.10.08 Harbor Bottom
	21.11 Waterfront Specialties	21.11.01 Fixed Fender Piles - Wood
		21.11.02 Fixed Fender Piles - Concrete
		21.11.03 Fixed Fender Piles - Metal
		21.11.04 Fixed Fender Bracing, Wales and Chocks - Wood
		21.11.05 Fixed Fender Bracing, Wales and Chocks - Concrete
		21.11.06 Fixed Fender Bracing, Wales and Chocks - Metal
		21.11.07 Fixed Fender Bearing Panels - Wood
		21.11.08 Fixed Fender Bearing Panels - Concrete
		21.11.09 Floating Fenders - Foam Filled/Pneumatic
		21.11.10 Fixed Hung Fender Systems - Wood

21 WATERFRONT

Figure 21-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
21 WATERFRONT (Continued)	21.11 Waterfront Specialties (Continued)	21.11.11 Fixed Directly Mounted Fender Units
		21.11.12 Cables and Cable Connectors - Metal
		21.11.13 Chafing Strips - Wood
		21.11.14 Chafing Strips and Bands - Metal
		21.11.15 Chafing Strips and Wraps - Rubber/Plastic
		21.11.16 Floating Single and Built-Up Log Camels - Wood
		21.11.17 Floating Crib Camels and Separators - Wood
		21.11.18 Floating Deep/Shallow Camels and Separators - Metal Framed

21.01 DOLPHINS

DESCRIPTION

Dolphins are a subsystem of the Waterfront System. A dolphin consists of one pile, or a cluster of up to 19 piles bound together with wire rope cables to form a structure. Dolphins are placed near piers, wharves, quaywalls and docks or in turning basins or ships channels, to guide vessels into their berths, used for anchorage or to fend vessels away from structures, shoals, or the shore to prevent damage to a vessel or shore structures by impact or abrasion.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Dolphins:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Dolphins, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.01.01 PILES - WOOD
- ◆ 21.01.02 CABLES/CABLE CONNECTORS
- ◆ 21.01.03 WEDGE BLOCKS, CHOCKS AND BOLTS
- ◆ 21.01.04 CHAFING STRIPS/BANDS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.02 WHARVES
21.03 PIERS

21.01 DOLPHINS

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.01.01 PILES - WOOD

A pile is a long slender wooden structural member which is driven, jetted or otherwise embedded into the ground beneath the water level to support a vertical load or to resist lateral forces. For observations involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or damaged pile caps.**			
Observation:			
a. Damaged or missing pile caps.	EA		
*** {Severity L}			
*** Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.01 PILES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.02 CABLES/CABLE CONNECTORS

Wire rope cables and cable connectors are used to lash together the above-water, top section of timber piles to form a dolphin pile cluster.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged cables.**			
Observation:			
a. Loose cables.	LF		
*** {Severity L}			
b. Worn cables.	LF		
*** {Severity M}			
c. Broken or missing cables.	LF		
*** {Severity H}			
*** Damaged connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity L}			
b. Cracked, broken or missing connectors.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.03 WEDGE BLOCKS, CHOCKS AND BOLTS

Wedge blocks and bolts are strategically placed and securely fastened within a timber dolphin pile cluster to separate and batter individual piles, and shape the cluster to form a structural unit. Chocking consists of wedges or blocks, fitted between piling to steady them. Chock bolt hangers are attached to dolphin piles to support the chocking. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Damaged wedge blocks/chocks.**			
Observation:			
a. Loose wedge blocks/chocks.	EA		
*** {Severity L}			
b. Cracked, broken or missing wedge blocks/chocks.	EA		
*** {Severity H}			
* **Damaged bolts/bolt hangers.**			
Observation:			
a. Loose bolts/bolt hangers.	EA		
*** {Severity L}			
b. Cracked, broken or missing bolt/bolt hangers.	EA		
*** {Severity H}			
* **Insect, rot or fungi damage.**			
Observation:			
a. Insect infestation or decay of wood wedge blocks/chocks, indicated by any loss of material thickness.	EA	2	
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.03 WEDGE BLOCKS, CHOCKS AND BOLTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.04 CHAFING STRIPS/BANDS

Chafing strips are fitted to the berthing faces of pilings to protect the piling against abrasion from contact with vessels, other structures, ropes or chains. Chafing strips are attached using countersunk bolts and metal bands. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion of metal band.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
*** Damaged chafing strips.**			
Observation:			
a. Loose chafing strips.	EA		
*** {Severity M}			
b. Cracked, broken or missing chafing strips.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage.**			
Observation:			
a. Insect infestation or decay of wood chafing strips, indicated by any loss of material thickness.	EA		
*** {Severity H}			

21.01 DOLPHINS

COMPONENTS (Continued)

◆ 21.01.04 CHAFING STRIPS/BANDS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Damaged bands.**			
Observation:			
a. Loose bands.	EA		
*** {Severity L}			
b. Cracked, broken or missing bands.	EA		
*** {Severity H}			
* **Damaged bolts.**			
Observation:			
a. Loose bolts.	EA		
*** {Severity L}			
b. Cracked, broken or missing bolts.	EA		
*** {Severity H}			

21.01 DOLPHINS

REFERENCES

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

3. NAVFAC DM-25, Waterfront Operational Facilities

4. NAVDOCKS P-272, Part 1, Vol. I, Definitive Designs for Shore Facilities

5. TM 5-622/MO-104/AFM 91-34, Maintenance of Waterfront Facilities

6. NAVFAC MO-312, Wood Protection, 1990

21.01 DOLPHINS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.01.01-1
2	GS-II 21.01.03-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.01.01-1

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-II 21.01.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15% of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: WEDGE BLOCKS, CHOCKS AND BOLTS
CONTROL NUMBER: GS-II 21.01.03-2

Application

This guide applies to the investigation of possible deterioration of wood wedge blocks and chocks due to insect infestation, rot or fungi damage, and possible damage or deterioration of associated metal bolts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area of wood chock or block that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas of wedge block or chock with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the wedge block or chock exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.01.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.01.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, VA
6. NAVFAC MO-312, Wood Protection, 1990

21.02 WHARVES

DESCRIPTION

Wharves are a subsystem of the Waterfront System. A wharf is an open-type marginal structure for berthing of vessels, which is usually parallel to the shoreline and connected to the shore at more than one point but does not have continuous access to the shore.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of the Wharves:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife
9. Dye, paintbrush, developer and rags

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Wharves, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.02.01 PILES - WOOD
- ◆ 21.02.02 PILES - CONCRETE
- ◆ 21.02.03 PILES - METAL
- ◆ 21.02.04 PILE CAPS - WOOD
- ◆ 21.02.05 PILE CAPS - CONCRETE
- ◆ 21.02.06 PILE CAPS - METAL
- ◆ 21.02.07 BRACING - WOOD
- ◆ 21.02.08 BRACING - METAL

21.02 WHARVES

COMPONENT LIST (Continued)

- 21.02.09 DECK SURFACES - WOOD
- 21.02.10 DECK SURFACES - CONCRETE
- 21.02.11 DECK SURFACES - METAL
- 21.02.12 HANDRAILS/GUARDRAILS - WOOD
- 21.02.13 HANDRAILS/GUARDRAILS - CONCRETE
- 21.02.14 HANDRAILS/GUARDRAILS - METAL
- 21.02.15 CATWALKS - WOOD
- 21.02.16 CATWALKS - METAL
- 21.02.17 LADDERS - WOOD
- 21.02.18 LADDERS - METAL
- 21.02.19 DECK CURBING - WOOD
- 21.02.20 DECK CURBING - CONCRETE
- 21.02.21 DECK CURBING - METAL
- 21.02.22 DECK SCUPPERS AND DRAINS - CONCRETE
- 21.02.23 DECK, SCUPPERS AND DRAINS - METAL
- 21.02.24 MANHOLE COVERS - METAL
- 21.02.25 MARINE HARDWARE - METAL
- 21.02.26 FIREWALL PARTITIONS - WOOD
- 21.02.27 FIREWALL PARTITIONS - CONCRETE
- 21.02.28 FIREWALL PARTITIONS - METAL
- 21.02.29 STRUCTURAL FRAME MEMBERS - WOOD
- 21.02.30 STRUCTURAL FRAME MEMBERS - CONCRETE
- 21.02.31 STRUCTURAL FRAME MEMBERS - METAL
- 21.02.32 RIPRAP
- 21.02.33 HARBOR BOTTOMS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.01	DOLPHINS
21.03	PIERS
21.06	QUAYWALLS
21.07	JETTIES
21.08	BREAKWATERS
21.09	GROINS
21.10	SEAWALLS
21.11	WATERFRONT SPECIALTIES

21.02 WHARVES

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.02.01 PILES - WOOD

A wood pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. For observations involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
* **Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.01 PILES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.02 PILES - CONCRETE

A concrete pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. Both above-water and underwater portions of the pile shall be inspected. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles.**			
Observation:			
a. Missing, broken or fractured piles.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	2	2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	2	2
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	2	3
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	2	3
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting evident, cracks occurring parallel to reinforcement.	SF	2	3
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.03 PILES - METAL

A metal pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. In underpinning, piles are most commonly composed of steel cylinders filled with concrete and "H" steel members. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	3	4
*** {Severity H}			
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	3	4
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.03 PILES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent.	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent.	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.04 PILE CAPS - WOOD

A wood pile cap is connecting beams which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose pile caps.**			
Observation:			
a. Loose pile cap.	EA		
*** {Severity M}			
b. Missing pile cap.	EA		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically damaged or broken.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF		4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	SF		4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF		4
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.05 PILE CAPS - CONCRETE

A concrete pile cap is a slab or connecting beam which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged or loose pile caps.**			
Observation:			
a. Physically loose pile cap.	EA		
*** {Severity M}			
b. Missing or damaged pile cap.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	5	
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	5	
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	6	
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.05 PILE CAPS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	6	
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting evident, cracks occurring parallel to reinforcement.	SF	6	
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.06 PILE CAPS - METAL

A metal pile cap is a plate or connecting beam which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act like a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, cracked or buckled pile cap.**			
Observation:			
a. Cracked or buckled pile cap.	LF	7	
*** {Severity H}			
b. Missing pile cap.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA	7	
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.07 BRACING - WOOD

Wood bracing are structural members of wood used for bracing other members so that the complete assembly forms a stable structure. Both above-water and underwater portions of the bracing shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 5, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken, or split member.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage.**			
Observation:			
a. Insect infestation or wood decay, indicated by any loss of material thickness.	EA	5	
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ **21.02.07 BRACING - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
b. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.08 BRACING - METAL

Metal bracing are structural members of steel used for bracing other members so that the complete assembly forms a stable structure. Both above-water and underwater portions of the bracing shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 6, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.08 BRACING - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
* Deteriorated protective covering.			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.09 DECK SURFACES - WOOD

Wharf wood deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	7	8
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	7	8
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	7	8
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.10 DECK SURFACES - CONCRETE

Wharf concrete deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		9
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		9
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		10
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.10 DECK SURFACES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		10
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		10
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
*** Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.11 DECK SURFACES - METAL

Wharf metal deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		11
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
b. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		11
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.11 DECK SURFACES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
* **Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
* **Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.12 HANDRAILS/GUARDRAILS - WOOD

A wood handrail or guardrail on the wharf deck is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	LF		
*** {Severity M}			
b. Discolored, soft or crushed area.	LF	8	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and saw dust observed.	LF	8	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	8	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.13 HANDRAILS/GUARDRAILS - CONCRETE

A concrete handrail or guardrail on the wharf deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged concrete handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.13 HANDRAILS/GUARDRAILS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.14 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail on the wharf deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.15 CATWALKS - WOOD

A wooden catwalk, ramp or brow to provide egress to an otherwise inaccessible area, usually for light traffic, consists of a wood frame with wood sheathing or plank decking and related supports. The surface will normally have a treatment or covering.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	9	12
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	9	12
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	9	12
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Loose, damaged, or missing covering.	SF		
*** {Severity L}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.15 CATWALKS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
b. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.16 CATWALKS - METAL

A metal catwalk, ramp or brow to provide egress to an otherwise inaccessible area, usually for light traffic, consists of a metal frame with a metal plate or grate decking, usually with a rubberized runner or safety tread and related supports. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		13
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
b. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
c. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		13
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.16 CATWALKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.17 LADDERS - WOOD

Wooden ladders on the wharf deck are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. Wooden ladders are typically constructed with side rails of 2" nominal thickness and rungs of 1 5/32" diameter. The wooden rungs may be reinforced with steel rods.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection site.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection site.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Split, cracked or broken members.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged, broken or deflected.	LF		
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	10	
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.17 LADDERS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	LF	10	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, crushing.	LF	10	
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.18 LADDERS - METAL

Metal ladders on the wharf deck are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. A steel ladder typically is 18" wide with 3/4" diameter rungs spaced 12" on-center and wall brackets maintaining a 7" clearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	1	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformed, twisted, or bent.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF	1	
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.19 DECK CURBING - WOOD

Wood curbing on the wharf deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress, to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose curbing.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing curbing section.	LF		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged or broken.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF		
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	LF		
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ **21.02.19 DECK CURBING - WOOD**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.20 DECK CURBING - CONCRETE

Concrete curbing on the wharf deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress, to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose curbing section.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area,with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.20 DECK CURBING - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.21 DECK CURBING - METAL

Metal curbing on the wharf deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loose, broken or missing curbing section.**			
Observation:			
a. Loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.22 DECK SCUPPERS AND DRAINS - CONCRETE

Concrete scuppers and drains on the wharf deck are strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage of water and drains are channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers or drains.**			
Observation:			
a. Clogged scuppers or drains.	EA		
*** {Severity L}			
b. Broken scuppers.	EA		
*** {Severity H}			
c. Broken drains.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.23 DECK, SCUPPERS AND DRAINS - METAL

Metal scuppers and drains on the wharf deck are strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage of water and drains are channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers, drains or curb slots.**			
Observation:			
a. Clogged drain.	EA		
*** {Severity L}			
b. Missing, broken or loose blots.	EA		
*** {Severity L}			
c. Missing or broken drain covers or scuppers.	EA		
*** {Severity H}			
*** Corroded scuppers or drains.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.24 MANHOLE COVERS - METAL

Metal manhole covers on the wharf deck cover manhole access passages in the deck.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective manhole covers.**			
Observation:			
a. Loose hinge pins.	EA		
*** {Severity L}			
b. Bent, worn, or missing hinge pins.	EA		
*** {Severity M}			
c. Broken or missing covers.	EA		
*** {Severity H}			
* **Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.25 MARINE HARDWARE - METAL

Metal marine hardware fittings consist of bollards, bitts, cleats, chocks and capstans all strategically located along the wharf deck and securely anchored to the structure to facilitate handling lines for vessel mooring and waterfront operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective marine hardware.**			
Observation:			
a. Rough or sharp line contact surfaces.	EA		
*** {Severity L}			
b. Loose, missing or defective bolts.	EA		
*** {Severity M}			
c. Worn, broken or missing.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.26 FIREWALL PARTITIONS - WOOD

Wooden firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	12	14
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and saw dust observed.	SF	12	14
*** {Severity M}			
b. Holes greater than 1/8" diameter.	SF	12	14
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.27 FIREWALL PARTITIONS - CONCRETE

Concrete firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		15
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		15
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		16
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.27 FIREWALL PARTITIONS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		16
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		16
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.28 FIREWALL PARTITIONS - METAL

Metal firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		17
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		17
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.29 STRUCTURAL FRAME MEMBERS - WOOD

Wood structural frame members designed to function as strength members for wharf structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	13	18
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	13	18
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	13	18
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
b. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.30 STRUCTURAL FRAME MEMBERS - CONCRETE

Concrete structural frame members designed to function as strength members for wharf structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	1	9
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	1	9
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		20
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.30 STRUCTURAL FRAME MEMBERS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		20
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		20
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.31 STRUCTURAL FRAME MEMBERS - METAL

Steel structural frame members designed to function as strength members for wharf structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	2	1
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		21
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.31 STRUCTURAL FRAME MEMBERS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

♦ 21.02.32 RIPRAP

Riprap consists of stones, boulders or concrete armor units of miscellaneous sizes placed without order on the surface of an earthen structure or embankment to act as protection against erosion caused by wave actions. Both above-water and underwater portions of the riprap shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Loss of section.	SF		
*** {Severity H}			
e. Undermining of foundation.	SF		
*** {Severity H}			

21.02 WHARVES

COMPONENTS (Continued)

◆ 21.02.33 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the wharf structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material (estimated volume).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, greater than 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, greater than 2′ deep.	SF		
*** {Severity H}			

21.02 WHARVES

REFERENCES

1. NAVFAC DM-2, Series Structural Engineering
2. NAVFAC DM-2.02, Structural Engineering General Requirements
3. NAVFAC DM-2.02, Structural Engineering Loads
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. NAVFAC MO-312, Wood Protection, 1990
6. Means Concrete Repair and Maintenance, Peter Emmons, 1984
7. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
8. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
9. NAVFAC DM-25, Waterfront Operational Facilities
10. NAVDOCKS P-272, Part I, Vol. I, Definitive Designs for Shore Facilities
11. U.S. Department of Transportation, Bridge Inspector's Training Manual/1990
12. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1990
13. U.S. Army TM5-624, Maintenance and Repair of Surface Areas

ATTACHMENTS

1. List of Reference Drawings - Waterfront System

21.02 WHARVES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.02.01-1
2	GS-II 21.02.02-2
3	GS-II 21.02.03-3
4	GS-II 21.02.04-4
5	GS-II 21.02.07-5
6	GS-II 21.02.08-6
7	GS-II 21.02.09-7
8	GS-II 21.02.12-8
9	GS-II 21.02.15-9
10	GS-II 21.02.17-10
11	GS-II 21.02.18-11
12	GS-II 21.02.26-12
13	GS-II 21.02.29-13

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.02.01-1
2	GS-III 21.02.02-2
3	GS-III 21.02.02-3
4	GS-III 21.02.03-4
5	GS-III 21.02.05-5
6	GS-III 21.02.05-6
7	GS-III 21.02.06-7
8	GS-III 21.02.09-8
9	GS-III 21.02.10-9
10	GS-III 21.02.10-10
11	GS-III 21.02.11-11
12	GS-III 21.02.15-12
13	GS-III 21.02.16-13
14	GS-III 21.02.26-14
15	GS-III 21.02.27-15
16	GS-III 21.02.27-16
17	GS-III 21.02.28-17
18	GS-III 21.02.29-18
19	GS-III 21.02.30-19
20	GS-III 21.02.30-20

21.02 WHARVES

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER (Continued)
21	GS-III 21.02.31-21
22*	GS-III 21.02.33-22*

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-II 21.02.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-II 21.02.02-2

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-II 21.02.03-3

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of steel piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: PILE CAPS - WOOD
CONTROL NUMBER: GS-II 21.02.04-4

Application

This guide applies to the investigation of deterioration of wood pile caps due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: BRACING - WOOD
CONTROL NUMBER: GS-II 21.02.07-5

Application

This guide applies to the investigation of possible deterioration of wood bracing members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bracing, wale or chock exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: BRACING - METAL
CONTROL NUMBER: GS-II 21.02.08-6

Application

This guide applies to the investigation of possible damage or deterioration of metal bracing.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-II 21.02.09-7

Application

This guide applies to the investigation of deterioration of wood planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 21.02.12-8

Application

This guide applies to the investigation of deterioration of wood handrail/guardrail members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-II 21.02.15-9

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 10

COMPONENT: LADDERS- WOOD
CONTROL NUMBER: GS-II 21.02.17-10

Application

This guide applies to the investigation of deterioration of wood ladders due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 11

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 21.02.18-11

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 12

COMPONENT: FIREWALL PARTITIONS - WOOD
CONTROL NUMBER: GS-II 21.02.26-12

Application

This guide applies to the investigation of deterioration of wood firewall partition members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 13

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-II 21.02.29-13

Application

This guide applies to the investigation of deterioration of structural wood members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.02.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.02.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.02.02-2

Application

This guide applies to the investigation of cracks in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity equipment to determine extent of subsurface damage from cracks.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.02.02-2

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.02.02-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.02.02-3

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.02.03-4

Application

This guide applies to the investigation of cracks and cracked welds in steel piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from suspected area using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Inspect extent of deformation for cracks.
3. Perform ultrasonic pulse velocity test to determine degree of cracking.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.02.03-4

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.02.05-5

Application

This guide applies to the investigation of cracks in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.02.05-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: PILE CAPS - METAL
CONTROL NUMBER: GS-III 21.02.06-7

Application

This guide applies to the investigation of cracks and cracked welds in steel pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-III 21.02.09-8

Application

This guide applies to the investigation of deterioration of wood deck planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.02.10-9

Application

This guide applies to the investigation of cracks in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
2. Check general appearance for any conditions that may cause cracking or surface deterioration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Schmidt test hammer
2. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.02.10-9

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.02.10-10

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: DECK SURFACES - METAL
CONTROL NUMBER: GS-III 21.02.11-11

Application

This guide applies to the investigation of cracks and cracked welds in metal deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-III 21.02.15-12

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: CATWALKS - METAL
CONTROL NUMBER: GS-III 21.02.16-13

Application

This guide applies to the investigation of cracks and cracked welds in metal catwalk members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: FIREWALL PARTITIONS - WOOD
CONTROL NUMBER: GS-III 21.02.26-14

Application

This guide applies to the investigation of deterioration of wood firewall partitions due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.02.27-15

Application

This guide applies to the investigation of cracks in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.02.27-16

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: FIREWALL PARTITIONS - METAL
CONTROL NUMBER: GS-III 21.02.28-17

Application

This guide applies to the investigation of cracks and cracked welds in metal firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-III 21.02.29-18

Application

This guide applies to the investigation of deterioration of wood structural frame members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.02.30-19

Application

This guide applies to the investigation of cracks in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.02.30-20

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: STRUCTURAL FRAME MEMBERS - METAL
CONTROL NUMBER: GS-III 21.02.31-21

Application

This guide applies to the investigation of cracks and cracked welds in metal structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.02.33-22*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:
   a. Operation must be conducted experienced personnel.
   b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
   c. Proper protective clothing and equipment must be used.
   d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
   e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
   f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22* (Continued)**

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.02.33-22***

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.03 PIERS

DESCRIPTION

Piers is a subsystem of the Waterfront System. A pier is an open or closed type structure usually extending perpendicular from the shore into navigable water, designed for berthing, loading or unloading cargo, repair, fueling, and general servicing of vessels. It normally provides berthing space on both sides of its entire length.

Pier Types: (See Sketch No. 21.03-A)

a. Open piers are pile supported platform structures which allow water to flow underneath.

b. Closed piers, or solid fill piers, are constructed so that water is prevented from flowing underneath. The solid fill pier is surrounded along the perimeter by a bulkhead to hold back fill.

c. Mole piers, special closed piers, are normally massive earthen structures. The sides and offshore end are retained and protected by riprap, a sheet-pile bulkhead of either prestressed or reinforced concrete, or a gravity type wall of either masonry or concrete. These structures are sometimes used as breakwaters. Generally, the top surface of a mole structure has an appreciable surface area.

d. Floating piers are constructed of steel or concrete and are connected to the shore with access ramps. Guide piles in the center of the pier, or a chain anchorage system, prevent lateral movement and allow the pier to move up and down with the tide.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Piers:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS (Continued)

8. Ice pick or pocket knife
9. Dye, paintbrush, developer and rags

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

21.03 PIERS

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Piers, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- 21.03.01 PILES - WOOD
- 21.03.02 PILES - CONCRETE
- 21.03.03 PILES - METAL
- 21.03.04 PILE CAPS - WOOD
- 21.03.05 PILE CAPS - CONCRETE
- 21.03.06 PILE CAPS - METAL
- 21.03.07 BULKHEADS - WOOD
- 21.03.08 BULKHEADS - CONCRETE
- 21.03.09 BULKHEADS - METAL
- 21.03.10 BULKHEADS - STONE MASONRY
- 21.03.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL
- 21.03.12 PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD
- 21.03.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL
- 21.03.14 DECK SURFACES - WOOD
- 21.03.15 DECK SURFACES - CONCRETE
- 21.03.16 DECK SURFACES - METAL
- 21.03.17 HANDRAILS/GUARDRAILS - WOOD
- 21.03.18 HANDRAILS/GUARDRAILS - CONCRETE
- 21.03.19 HANDRAILS/GUARDRAILS - METAL
- 21.03.20 CATWALKS - WOOD
- 21.03.21 CATWALKS - METAL
- 21.03.22 LADDERS - WOOD
- 21.03.23 LADDERS - METAL
- 21.03.24 DECK CURBING - WOOD
- 21.03.25 DECK CURBING - CONCRETE
- 21.03.26 DECK CURBING - METAL
- 21.03.27 DECK SCUPPERS AND DRAINS - CONCRETE
- 21.03.28 DECK SCUPPERS AND DRAINS - METAL
- 21.03.29 MANHOLE COVERS - METAL
- 21.03.30 MARINE HARDWARE - METAL
- 21.03.31 FIREWALL PARTITIONS - WOOD
- 21.03.32 FIREWALL PARTITIONS - CONCRETE
- 21.03.33 FIREWALL PARTITIONS - METAL
- 21.03.34 STRUCTURAL FRAME MEMBERS - WOOD
- 21.03.35 STRUCTURAL FRAME MEMBERS - CONCRETE
- 21.03.36 STRUCTURAL FRAME MEMBERS - METAL
- 21.03.37 ROCK DIKES
- 21.03.38 RIPRAP
- 21.03.39 HARBOR BOTTOM

21.03 PIERS

COMPONENT LIST (Continued)

- 21.03.40 RUBBLE-MOUND STRUCTURES
- 21.03.41 RETAINING WALLS - CONCRETE
- 21.03.42 FLOATATION TANKS/BUOYANCY CHAMBERS - METAL
- 21.03.43 FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
- 21.03.44 FLOATING PIER FITTINGS - METAL
- 21.03.45 FLOATING PIER CHAIN ANCHORAGE SYSTEMS - METAL
- 21.03.46 FLOATING PIER ACCESS RAMPS - WOOD
- 21.03.47 FLOATING PIER ACCESS RAMPS - CONCRETE
- 21.03.48 FLOATING PIER ACCESS RAMPS - METAL

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.01 DOLPHINS
21.02 WHARVES
21.06 QUAYWALLS
21.07 JETTIES
21.08 BREAKWATERS
21.09 GROINS
21.10 SEAWALLS
21.11 WATERFRONT SPECIALTIES

21.03 PIERS

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.03.01 PILES - WOOD

A wood pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. For observations involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.01 PILES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.02 PILES - CONCRETE

A concrete pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces and support quaywall structures. Both above-water and underwater portions of the pile shall be inspected. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles.**			
Observation:			
a. Missing, broken or fractured piles.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	2	2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	2	2
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	2	3
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	2	3
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	2	3
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.03 **PILES - METAL**

A metal pile is a long slender structural member which is driven, jetted or otherwise embedded into this ground beneath the water to support vertical loads or to resist lateral forces. In underpinning, piles are most commonly composed of steel cylinders filled with concrete and "H" steel members. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent.	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	3	4
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.03 PILES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	3	4
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or welds.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.04 PILE CAPS - WOOD

A wood pile cap is connecting beams which covers the head of a group of piles, tying them together so that the structural load is distributed and then act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose pile caps.**			
Observation:			
a. Loose pile cap.	EA		
*** {Severity M}			
b. Missing pile cap.	EA		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically damaged or broken.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	4	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	SF	4	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	4	
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.05 PILE CAPS - CONCRETE

A concrete pile cap is a slab or connecting beam which covers the heads of a group of piles tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged or loose pile caps.**			
Observation:			
a. Physically loose pile cap.	EA		
*** {Severity M}			
b. Missing or damaged pile cap.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		5
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		5
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		6
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.05 PILE CAPS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		6
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		6
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.06 PILE CAPS - METAL

A metal pile cap is a plate or connecting beam which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, cracked or buckled pile cap.**			
Observation:			
a. Cracked or buckled pile cap.	LF		7
*** {Severity H}			
b. Missing pile cap.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		7
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.07 BULKHEADS - WOOD

A wood bulkhead is constructed of interlocking wood members driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 5, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken, or split member.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist, stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	5	8
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	SF	5	8
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	5	8
*** {Severity H}			
*** Erosion, displacement of material from behind bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.07 **BULKHEADS - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.08 BULKHEADS - CONCRETE

A concrete bulkhead is constructed of interlocking members of concrete driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 6, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	6	9
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	6	9
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ **21.03.08 BULKHEADS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	6	10
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	6	10
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	6	10
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.08 BULKHEADS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Erosion, displacement of material from behind bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.09 BULKHEADS - METAL

A metal bulkhead is constructed of interlocking members of steel driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 7, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Structurally damaged by impact or other means.**			
Observation:			
a. Loose or bent sections that do not result in an open seam or hole.	SF		
*** {Severity L}			
b. Open seams, holes or missing section in sheet piling.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		7
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.09 BULKHEADS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY 3
* **Erosion, displacement of material from behind openings in bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			
* **Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.10 BULKHEADS - STONE MASONRY

A stone masonry bulkhead wall is built to form a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 8, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective mortar.**			
Observation:			
a. Cracked joint material.	SF		
*** {Severity L}			
b. Loose/missing joint material.	SF		
*** {Severity H}			
*** Displacement of stones in wall surface.**			
Observation:			
a. Cracked or damaged stones.	SF		
*** {Severity M}			
b. Loose or missing stones.	SF		
*** {Severity H}			
*** Erosion, displacement of material from behind openings in bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of wall not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of wall exposed.	SF		
*** {Severity H}			
*** Misalignment of wall.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL

A tie rod is a steel rod used as a connector or brace. Steel tie rods and long bolts are used in conjunction with wood and steel bracing, wales, chocks, anchors and related fittings to structurally support and anchor wood, concrete or steel bulkhead members. Both the above-water and underwater portions of the tie rods and long bolts shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 9, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose.**			
Observation:			
a. Failure/missing wrappings on tie rods.	EA		
*** {Severity M}			
b. Lack of tautness.	EA		
*** {Severity M}			
c. Bent tie rods.	EA		
*** {Severity H}			
d. Missing or broken connections.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
*** Overloads.**			
Observation:			
a. Tension - elongated, necking down.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.12 PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD

Wood bracing are structural members of wood used for bracing other members so that the complete assembly forms a stable structure. Wales are long, horizontal braces. A chock is a wedge or block, commonly wooden, fitted between piling or other structures to steady them. Bracing, wales and chocks are used in conjunction with tie rods, long bolts and related fittings to structurally support and anchor bulkhead members. Both above-water and underwater portions of the bracing, wales and chocks shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 10, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken, or split member.	SF		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage.**			
Observation:			
a. Insect infestation or decay of wood, indicated by any loss of material thickness.	EA		10
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL

Steel bracing are structural members of steel used for bracing other members so that the complete assembly forms a stable structure. Wales are long, horizontal braces. A chock is a wedge or block, fitted between piling or other structural members to steady them. Bracing, wales and chocks are used in conjunction with tie rods, long bolts and related fittings to structurally support and anchor bulkhead members. Both above-water and underwater portions of the bracing, wales and chocks shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 11, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.14 DECK SURFACES - WOOD

Pier wood deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	12	11
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	12	11
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	12	11
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.15 DECK SURFACES - CONCRETE

Concrete deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		12
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		12
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		13
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.15 **DECK SURFACES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		13
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		13
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
*** Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.16 DECK SURFACES - METAL

Metal deck surfaces are installed to provide a hard surface in order to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		14
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
b. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
c. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		14
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ **21.03.16** **DECK SURFACES - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
* **Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
* **Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.17 HANDRAILS/GUARDRAILS - WOOD

A wood handrail or guardrail on the pier deck is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	13	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	LF	13	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	13	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.18 HANDRAILS/GUARDRAILS - CONCRETE

A concrete handrail or guardrail on the pier deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged concrete handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
c. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.18 HANDRAILS/GUARDRAILS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.19 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail on the pier deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.20 CATWALKS - WOOD

A wooden catwalk, ramp or brow, to provide egress to an otherwise inaccessible area, usually for light traffic, consists of a wood frame with wood sheathing or plank decking and related supports. The surface will normally have a treatment or covering.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	14	15
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	14	15
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	14	15
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Loose, damaged, or missing covering.	SF		
*** {Severity L}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.20 **CATWALKS - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.21 CATWALKS - METAL

A metal catwalk, ramp or brow, to provide egress to an otherwise inaccessible area, usually for light traffic, consists of a metal frame with a metal plate or grate decking, usually with a rubberized runner or safety tread and related supports. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		16
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
b. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		16
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.21 CATWALKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.22 LADDERS - WOOD

Wooden ladders on the pier deck are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. Wooden ladders are typically constructed with side rails of 2" nominal thickness and rungs of 1 5/32" diameter. The wooden rungs may be reinforced with steel rods.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection site.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection site.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Split, cracked or broken members.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged, broken or deflected.	LF		
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	15	
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.22 LADDERS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	LF	15	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, crushing.	LF	15	
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.23 LADDERS - METAL

Metal ladders on the pier deck are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. A metal ladder typically is 18" wide with 3/4" diameter rungs spaced 12" on-center and wall brackets maintaining a 7" clearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	16	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformed, twisted, or bent.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		16
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.24 DECK CURBING - WOOD

Wood curbing on the pier deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose curbing.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing curbing section.	LF		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged or broken.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF		
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	LF		
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.24 **DECK CURBING - WOOD**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.25 DECK CURBING - CONCRETE

Concrete curbing on the pier deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose curbing section.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6"in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.25 DECK CURBING - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.26 DECK CURBING - METAL

Steel curbing on the pier deck is strategically located, usually along the outer edge, to confine traffic and facilitate safe egress to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loose, broken or missing curbing section.**			
Observation:			
a. Loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.27 DECK SCUPPERS AND DRAINAGE SLOTS - CONCRETE

Concrete scuppers and drains on the pier deck are strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage of water and drains are channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers or drainage slots.**			
Observation:			
a. Clogged openings.	EA		
*** {Severity L}			
b. Broken trough.	EA		
*** {Severity M}			
c. Broken scuppers or slots.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.28 DECKS, SCUPPERS AND DRAINAGE SLOTS- METAL

Metal, scuppers and drains on the pier deck are strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage of water and drains channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers, drains or curb slots.**			
Observation:			
a. Clogged or drains.	EA		
*** {Severity L}			
b. Missing, broken or loose bolts.	EA		
*** {Severity L}			
c. Broken drains, drain covers or scupper.	EA		
*** {Severity H}			
*** Corroded scuppers or drains.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.29 MANHOLE COVERS - METAL

Metal manhole covers on the pier deck cover manhole access passages in the deck.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective manhole covers.**			
Observation:			
a. Loose hinge pins.	EA		
*** {Severity L}			
b. Bent, worn, or missing hinge pins.	EA		
*** {Severity M}			
c. Broken or missing covers.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.30 MARINE HARDWARE - METAL

Metal marine hardware fittings consist of bollards, bitts, cleats, chocks and capstans all strategically located along the pier deck and securely anchored to the structure to facilitate handling lines for vessel mooring and waterfront operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective marine hardware.**			
Observation:			
a. Rough or sharp line contact surfaces.	EA		
*** {Severity L}			
b. Loose, missing or defective bolts.	EA		
*** {Severity M}			
c. Worn, broken or missing.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.31 FIREWALL PARTITIONS - WOOD

Wooden firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	17	17
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	SF	17	17
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	17	17
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.32 FIREWALL PARTITIONS - CONCRETE

Concrete firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		18
*** {Severity H}			
d. Disintegration of surface or cracks exceeding depth of 2".	SF		18
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area,with corrosion of exposed reinforcing steel.	SF		19
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.32 FIREWALL PARTITIONS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		19
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		19
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.33 FIREWALL PARTITIONS - METAL

Metal firewall partitions are of airtight construction installed on the underside of the open type construction section of a wharf. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		20
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		20
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.34 STRUCTURAL FRAME MEMBERS - WOOD

Wood structural frame members designed to function as strength members for pier structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	18	21
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	18	21
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	18	21
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.35 STRUCTURAL FRAME MEMBERS - CONCRETE

Concrete structural frame members designed to function as strength members for pier structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		22
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		22
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		23
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.35 STRUCTURAL FRAME MEMBERS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		23
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		23
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.36 STRUCTURAL FRAME MEMBERS - METAL

Steel structural frame members designed to function as strength members for pier structures include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		24
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		24
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.37 ROCK DIKES

Rock dikes are an artificial embankments or ridges consisting of stones, boulders or concrete armor units of various sizes placed on the bottom or on the firm bottom embankment. All voids are completely filled and compacted as needed to act as protection against erosion and to retain the embankment or fill material. Both above-water and underwater portions of the rock dike shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in dike.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Loss of section.	SF		
*** {Severity H}			
e. Undermining of foundation.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.38 RIPRAP

Riprap consists of stones, boulders or concrete armor units of miscellaneous sizes placed without order on the surface of an earthen structure or embankment to act as protection against erosion caused by wave actions. Both above-water and underwater portions of the riprap shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Loss of section.	SF		
*** {Severity H}			
e. Undermining of foundation.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.39 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the pier structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material (area of pier structure affected).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, greater than 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, greater than 2′ deep.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.40 RUBBLE-MOUND STRUCTURES

A rubble-mound structure is an artificial embankment or ridge constructed on the ocean floor consisting of stones, boulders or concrete armor units of various sizes to act as protection against erosion and scour by water flow, wave or other movement. Both above water and underwater portions of the rubble-mound structure shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Undermining of foundation.	SF		
*** {Severity H}			
e. Washing out of substrate at toe of structure.	SF		
*** {Severity H}			
f. Dislodgement of capstones by wave action.	SF		
*** {Severity H}			
g. Loss of section.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.41 RETAINING WALLS - CONCRETE

Concrete retaining walls with or without reinforcement and with or without a concrete footing or metal tieback rods anchored to a deadman". Weep holes are provided for drainage. Walls out of level or out of plumb may be checked by eyesight, a string line between the main corners, or a transit. Both above-water and underwater portions of the retaining wall shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 19, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	19	26
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	19	26
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	19	27
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ **21.03.41 RETAINING WALLS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	19	27
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	19	27
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Erosion, displacement of material from behind retaining wall.**			
Observation:			
a. Erosion below existing grade line, base of retaining wall not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of retaining wall exposed.	SF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ **21.03.41 RETAINING WALLS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Misalignment.**			
Observation:			
a. Movement of retaining wall greater than 1 foot displacement.	LF		
* * * {Severity M}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.42 FLOTATION TANKS/BUOYANCY CHAMBERS - METAL

Metal flotation tanks/buoyancy chambers are airtight tanks designed and strategically located within a floating pier structure to keep the structure from sinking and provide upward pressure to support waterfront operational requirements. Both above-water and underwater portions of the floating pier structure shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 20, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	EA		
*** {Severity H}			
* **Missing, punctured, cracked, dented or loose steel tanks.**			
Observation:			
a. Physically damaged with one crack, dented or loose tank.	EA		
*** {Severity M}			
b. Physically damaged with more than one crack, or punctured tank.	EA		
*** {Severity H}			
c. Missing tank.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.42 FLOTATION TANKS/BUOYANCY CHAMBERS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Misalignment/differential settlement.**			
Observation:			
a. Out of level, does not restrict normal operations.	EA		
*** {Severity L}			
b. Out of level, restricts normal operations.	EA		
*** {Severity H}			
c. Prevents free floatation.	EA		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

♦ 21.03.43 FLOTATION TANKS/BUOYANCY CHAMBERS - CONCRETE

Concrete flotation tanks/buoyancy chambers are airtight tanks designed and strategically located within a floating pier structure to keep the structure from sinking and provide upward pressure to support waterfront operational requirements. Both above-water and underwater portions of the floating pier structure shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 21, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	21	28
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	21	28
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	21	29
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.43 FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	21	29
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	21	29
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Misalignment/differential settlement.**			
Observation:			
a. Out of level, does not restrict normal operations.	EA		
*** {Severity L}			
b. Out of level, restricts normal operations.	EA		
*** {Severity H}			
c. Prevents free flotation.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.44 FLOATING PIER FITTINGS - METAL

Floating pier structures may have various related steel marine hardware fittings, consisting of hardware, connectors, chains, shackles or eye bolts strategically located to accommodate floating pier operational requirements. Both above-water and underwater fittings shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 22, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective pier fittings.**			
Observation:			
a. Loose, cracked, broken, or missing bolts.	EA		
*** {Severity H}			
b. Cracked, broken, or missing pier fittings.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.45 FLOATING PIER CHAIN ANCHORAGE SYSTEMS - METAL

Floating pier chain anchorage systems consist of anchors/sinkers, chains, cables, associated connectors and related marine hardware fittings to prevent lateral movement and allow the pier to float up and down with the tide. For inspection of floating pier guide piles, see Components 21.03.01, Piles - Wood, 21.03.02, Piles - Concrete and 21.03.03, Piles - Metal. Both above-water and underwater portions of the chain anchorage system shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 23, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective floating pier chain anchorage.**			
Observation:			
a. Loose, cracked, broken or missing bolts.	EA		
*** {Severity H}			
b. Cracked, broken or missing anchors, chains, cables, connectors or fittings.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
Misalignment.			
Observation:			
a. Restricts normal operations or access.	EA		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.46 FLOATING PIER ACCESS RAMPS - WOOD

A wooden access ramp is an inclined passageway to provide egress to an otherwise inaccessible area, usually for vehicle or heavy traffic. Consists of a wood frame with wood sheathing or plank decking and related supports. The inclined surface will normally have a treatment or covering. Any possible structural strength defect should be examined closely.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	24	30
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	24	30
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	24	30
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.46 FLOATING PIER ACCESS RAMPS - WOOD

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Loose, damaged or missing covering.	SF		
*** {Severity M}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.47 FLOATING PIER ACCESS RAMPS - CONCRETE

A concrete access ramp is an inclined passageway to provide egress to an otherwise inaccessible area, usually for vehicle or heavy traffic. It consists of cast-in-place or pre-cast, reinforced concrete with related supports. The inclined surface wall normally have a treatment or covering. Any possible structural strength defect should be examined closely.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		31
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		31
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		32
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.47 FLOATING PIER ACCESS RAMPS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		32
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		32
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Rough transition to upper surface.**			
Observation:			
a. Top elevation of ramp more than 1/4" higher or lower than elevation of upper surface at transition.	LF		
*** {Severity H}			

21.03 PIERS

COMPONENTS (Continued)

◆ 21.03.48 FLOATING PIER ACCESS RAMPS - METAL

A metal access ramp is an inclined passageway to an otherwise inaccessible area, usually for vehicle or heavy traffic. It consists of a metal frame with a metal plate or grate decking, usually with a rubberized runner or safety tread and related supports. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending. *** {Severity H}	SF		
b. Physically damaged member. *** {Severity H}	SF		
c. Stress or fatigue cracks. *** {Severity H}	SF		33
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	SF		
*** Surface deterioration.**			
Observation:			
b. Damaged or missing safety tread/runner. *** {Severity L}	SF		
c. Damaged or missing grating. *** {Severity L}	SF		
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners. *** {Severity M}	EA		
b. Cracked or broken welds. *** {Severity H}	EA		33

21.03 PIERS

COMPONENTS (Continued)

◆ **21.03.48** **FLOATING PIER ACCESS RAMPS - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.03 PIERS

REFERENCES

1. NAVFAC DM-2, Series Structural Engineering
2. NAVFAC DM-2.02, Structural Engineering General Requirements
3. NAVFAC DM-2.02, Structural Engineering Loads
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. NAVFAC MO-312, Wood Protection, 1990
6. Means Concrete Repair and Maintenance, Peter Emmons, 1984
7. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
8. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
9. NAVFAC DM-25, Waterfront Operational Facilities
10. NAVDOCKS P-272, Part I, Vol. I, Definitive Designs for Shore Facilities
11. U.S. Department of Transportation, Bridge Inspector's Training Manual/1990
12. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
13. U.S. Army TM5-624, Maintenance and Repair of Surface Areas

ATTACHMENTS

1. Sketch No. 21.03-A, Typical Pier Construction
2. List of Reference Drawings - Waterfront System

21.03 PIERS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.03.01-1
2	GS-II 21.03.02-2
3	GS-II 21.03.03-3
4	GS-II 21.03.04-4
5	GS-II 21.03.07-5
6	GS-II 21.03.08-6
7	GS-II 21.03.09-7
8	GS-II 21.03.10-8
9	GS-II 21.03.11-9
10	GS-II 21.03.12-10
11	GS-II 21.03.13-11
12	GS-II 21.03.14-12
13	GS-II 21.03.17-13
14	GS-II 21.03.20-14
15	GS-II 21.03.22-15
16	GS-II 21.03.23-16
17	GS-II 21.03.31-17
18	GS-II 21.03.34-18
19	GS-II 21.03.41-19
20	GS-II 21.03.42-20
21	GS-II 21.03.43-21
22	GS-II 21.03.44-22
23	GS-II 21.03.45-23
24	GS-II 21.03.46-24

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.03.01-1
2	GS-III 21.03.02-2
3	GS-III 21.03.02-3
4	GS-III 21.03.03-4
5	GS-III 21.03.05-5
6	GS-III 21.03.05-6
7	GS-III 21.03.06-7
8	GS-III 21.03.07-8
9	GS-III 21.03.08-9
10	GS-III 21.03.08-10
11	GS-III 21.03.14-11
12	GS-III 21.03.15-12
13	GS-III 21.03.15-13
14	GS-III 21.03.16-14
15	GS-III 21.03.20-15
16	GS-III 21.03.21-16
17	GS-III 21.03.31-17

21.03 PIERS

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
18	GS-III 21.03.32-18
19	GS-III 21.03.32-19
20	GS-III 21.03.33-20
21	GS-III 21.03.34-21
22	GS-III 21.03.35-22
23	GS-III 21.03.35-23
24	GS-III 21.03.36-24
25*	GS-III 21.03.39-25*
26	GS-III 21.03.41-26
27	GS-III 21.03.41-27
28	GS-III 21.03.43-28
29	GS-III 21.03.43-29
30	GS-III 21.03.46-30
31	GS-III 21.03.47-31
32	GS-III 21.03.47-32
33	GS-III 21.03.48-33

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-II 21.03.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-II 21.03.02-2

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-II 21.03.03-3

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of steel piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: PILE CAPS - WOOD
CONTROL NUMBER: GS-II 21.03.04-4

Application

This guide applies to the investigation of deterioration of wood pile caps due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-II 21.03.07-5

Application

This guide applies to the investigation of possible deterioration of wood bulkhead members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-II 21.03.08-6

Application

This guide applies to the investigation of possible deterioration of concrete bulkhead members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: BULKHEADS - METAL
CONTROL NUMBER: GS-II 21.03.09-7

Application

This guide applies to the investigation of possible deterioration of steel sheet piling.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine surface area affected by deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: BULKHEADS - STONE MASONRY
CONTROL NUMBER: GS-II 21.03.10-8

Application

This guide applies to the investigation of possible deterioration of stone masonry bulkheads.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL
CONTROL NUMBER: GS-II 21.03.11-9

Application

This guide applies to the investigation of possible damage or deterioration of metal tie rods and long bolts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 10

COMPONENT: PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD
CONTROL NUMBER: GS-II 21.03.12-10

Application

This guide applies to the investigation of possible deterioration of wood bracing, wales and chocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bracing, wale or chock exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 11

COMPONENT: PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL
CONTROL NUMBER: GS-II 21.03.13-11

Application

This guide applies to the investigation of possible damage or deterioration of metal bracing, wales and chocks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 12

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-II 21.03.14-12

Application

This guide applies to the investigation of deterioration of wood planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 13

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 21.03.17-13

Application

This guide applies to the investigation of deterioration of wood handrail/guardrail members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 14

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-II 21.03.20-14

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 15

COMPONENT: LADDERS- WOOD
CONTROL NUMBER: GS-II 21.03.22-15

Application

This guide applies to the investigation of deterioration of wood ladders due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 16

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 21.03.23-16

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 17

COMPONENT: FIREWALL PARTITIONS - WOOD
CONTROL NUMBER: GS-II 21.03.31-17

Application

This guide applies to the investigation of deterioration of wood firewall partition members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 18

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-II 21.03.34-18

Application

This guide applies to the investigation of deterioration of structural wood members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 19

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-II 21.03.41-19

Application

This guide applies to the investigation of possible deterioration of concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the retaining wall.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the retaining wall exterior with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 20

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - METAL
CONTROL NUMBER: GS-II 21.03.42-20

Application

This guide applies to the investigation of possible deterioration of metal floatation tanks/buoyancy chambers.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. The areas to be cleaned are designated as one-half square foot sections at spot locations rather than cleaning the entire tank.
2. Utilize calipers and scales to determine surface area affected by deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 21

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
CONTROL NUMBER: GS-II 21.03.43-21

Application

This guide applies to the investigation of possible deterioration of concrete floatation tanks/buoyancy chambers.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. The areas to be cleaned are designated as one-half square foot sections at spot locations rather than cleaning the entire tank.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the tank with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 22

COMPONENT: FLOATING PIER FITTINGS - METAL
CONTROL NUMBER: GS-II 21.03.44-22

Application

This guide applies to the investigation of possible damage or deterioration of metal hardware, connectors, chains, shackles and eye bolts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 23

COMPONENT: FLOATING PIER CHAIN ANCHORAGE SYSTEMS - METAL
CONTROL NUMBER: GS-II 21.03.45-23

Application

This guide applies to the investigation of possible damage or deterioration of metal anchors/sinkers, chains, cables, associated connectors and related fittings.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 24

COMPONENT: FLOATING PIER ACCESS RAMPS - WOOD
CONTROL NUMBER: GS-II 21.03.46-24

Application

This guide applies to the investigation of deterioration of wood ramps due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.03.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.03.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.03.02-2

Application

This guide applies to the investigation of cracks in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.03.02-2

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.03.02-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.03.02-3

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.03.03-4

Application

This guide applies to the investigation of cracks and cracked welds in steel piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from suspected area using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Inspect extent of deformation for cracks.
3. Perform ultrasonic pulse velocity test to determine degree of cracking.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.03.03-4

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.03.05-5

Application

This guide applies to the investigation of cracks in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment.

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.03.05-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: PILE CAPS - METAL
CONTROL NUMBER: GS-III 21.03.06-7

Application

This guide applies to the investigation of cracks and cracked welds in steel pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-III 21.03.07-8

Application

This guide applies to the investigation of possible deterioration of wood bulkheads due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of the bulkhead. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-III 21.03.07-8

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.03.08-9

Application

This guide applies to the investigation of cracks in concrete bulkhead walls.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
3. Take core samples of selected deteriorated areas in order to determine the cause and depth of deterioration, the chemical content, particularly chlorides, within the concrete, and the actual compressive strength. Following coring, the holes should be patched using an approved epoxy grout.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.03.08-9

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Schmidt test hammer
6. Increment borer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.03.08-10

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete bulkheads.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.03.08-10

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-III 21.03.14-11

Application

This guide applies to the investigation of deterioration of wood deck planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.03.15-12

Application

This guide applies to the investigation of cracks in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
2. Check general appearance for any conditions that may cause cracking or surface deterioration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Schmidt test hammer
2. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12 (Continued)

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.03.15-12

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.03.15-13

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: DECK SURFACES - METAL
CONTROL NUMBER: GS-III 21.03.16-14

Application

This guide applies to the investigation of cracks and cracked welds in metal deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-III 21.03.20-15

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: CATWALKS - METAL
CONTROL NUMBER: GS-III 21.03.21-16

Application

This guide applies to the investigation of cracks and cracked welds in metal catwalk members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: FIREWALL PARTITIONS - WOOD
CONTROL NUMBER: GS-III 21.03.31-17

Application

This guide applies to the investigation of deterioration of wood firewall partitions due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.03.32-18

Application

This guide applies to the investigation of cracks in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.03.32-19

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: FIREWALL PARTITIONS - METAL
CONTROL NUMBER: GS-III 21.03.33-20

Application

This guide applies to the investigation of cracks and cracked welds in metal firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-III 21.03.34-21

Application

This guide applies to the investigation of deterioration of wood structural frame members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.35-22

Application

This guide applies to the investigation of cracks in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.35-23

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24

COMPONENT: STRUCTURAL FRAME MEMBERS - METAL
CONTROL NUMBER: GS-III 21.03.36-24

Application

This guide applies to the investigation of cracks and cracked welds in metal structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.03.39-25*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:
    a. Operation must be conducted experienced personnel.
    b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
    c. Proper protective clothing and equipment must be used.
    d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
    e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
    f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25* (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.03.39-25*

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 26

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.03.41-26

Application

This guide applies to the investigation of cracks in concrete retaining walls.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
3. Take core samples of selected deteriorated areas in order to determine the cause and depth of deterioration, the chemical content, particularly chlorides, within the concrete, and the actual compressive strength. Following coring, the holes should be patched using an approved epoxy grout.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 26 (Continued)

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.03.41-26

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Schmidt test hammer
6. Increment borer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.03.41-27

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete retaining walls.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check fordamage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27 (Continued)

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.03.41-27

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 28

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.43-28

Application

This guide applies to the investigation of cracks in concrete floatation tanks/buoyancy chambers.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
3. Take core samples of selected deteriorated areas in order to determine the cause and depth of deterioration, the chemical content, particularly chlorides, within the concrete, and the actual compressive strength. Following coring, the holes should be patched using an approved epoxy grout.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 28 (Continued)

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.43-28

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Schmidt test hammer
6. Increment borer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC DM-25, Waterfront Operational Facilities
5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90
6. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 29

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.43-29

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete floatation tanks/buoyancy chambers.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 29 (Continued)

COMPONENT: FLOATATION TANKS/BUOYANCY CHAMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.03.43-29

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 30

COMPONENT: FLOATING PIER ACCESS RAMPS - WOOD
CONTROL NUMBER: GS-III 21.03.46-30

Application

This guide applies to the investigation of deterioration of wood ramps due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 31

COMPONENT: FLOATING PIER ACCESS RAMPS - CONCRETE
CONTROL NUMBER: GS-III 21.03.47-31

Application

This guide applies to the investigation of cracks in concrete access ramps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
2. Check general appearance for any conditions that may cause cracking or surface deterioration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Schmidt test hammer
2. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 31 (Continued)

COMPONENT: FLOATING PIER ACCESS RAMPS - CONCRETE
CONTROL NUMBER: GS-III 21.03.47-31

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 32

COMPONENT: FLOATING PIER ACCESS RAMPS - CONCRETE
CONTROL NUMBER: GS-III 21.03.47-32

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete ramp surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 33

COMPONENT: FLOATING PIER ACCESS RAMPS - METAL
CONTROL NUMBER: GS-III 21.03.48-33

Application

This guide applies to the investigation of cracks and cracked welds in metal access ramps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

21.04 GRAVING DRYDOCKS

DESCRIPTION

Graving Drydocks is a subsystem of the Waterfront System. A graving drydock is a partially submerged structure that is used to provide access to a ship's or boats hull for maintenance or repairs. Once the ship or boat is located within the drydock, the access is closed and the drydock drained.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of the Graving Drydock:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife
9. Dye, paintbrush, developer and rags

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of the Graving Drydocks beyond the requirements listed in the in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.04.01 CLOSURE WALLS - CONCRETE
- ◆ 21.04.02 CLOSURE WALLS - STONE MASONRY (CYCLOPEAN WALL)
- ◆ 21.04.03 DECK/FLOOR SURFACES - CONCRETE
- ◆ 21.04.04 CAISSONS
- ◆ 21.04.05 SLUICE GATES
- ◆ 21.04.06 FENDERS/CHAFING STRIPS
- ◆ 21.04.07 STAIR STRUCTURE - CONCRETE
- ◆ 21.04.08 STAIR STRUCTURE - METAL
- ◆ 21.04.09 LADDERS - METAL
- ◆ 21.04.10 CATWALKS/PLATFORMS - METAL
- ◆ 21.04.11 COPING - CONCRETE/GRANITE
- ◆ 21.04.12 REMOVABLE CHAIN RAILINGS
- ◆ 21.04.13 COLLECTOR CHANNEL/FLOODING CULVERT GRATING

21.04 GRAVING DRYDOCKS

COMPONENT LIST (Continued)

- ◆ 21.04.14 HANDRAILS/GUARDRAILS - METAL
- ◆ 21.04.15 MANHOLE COVERS - METAL
- ◆ 21.04.16 MARINE HARDWARE - METAL
- ◆ 21.04.17 CAPSTAN ASSEMBLY
- ◆ 21.04.18 KEEL AND BILGE BLOCKS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

07.02	DOMESTIC WATER SYSTEMS
07.03	SANITARY DISTRIBUTION SYSTEMS
07.04	STORM WATER DRAINAGE DISTRIBUTION SYSTEMS
07.05	COMPRESSED AIR SYSTEMS - SHOP
07.06	VACUUM SYSTEMS
07.07	GAS SYSTEMS
08.15	CHILLED WATER DISTRIBUTION SYSTEMS
08.17	STEAM DISTRIBUTION SYSTEMS
08.18	STEAM CONDENSATE RETURN SYSTEMS
08.20	AIR DISTRIBUTION SYSTEMS
08.27	SYSTEMS CONTROLS AND INSTRUMENTATION
09.09	STAND PIPE SYSTEMS
10.01	SERVICE ENTRANCE 600V OR LESS
10.02	LOW VOLTAGE DISTRIBUTION SYSTEM 600V OR LESS
10.03	MEDIUM VOLTAGE SYSTEM (601V TO 34.9KV)
10.04	LIGHTING
10.05	POWER CONTROL
10.06	GROUNDING SYSTEM
10.07	RACEWAYS
10.08	POWER SOURCES
10.09	MOTOR CONTROL CENTERS
10.10	SWITCHGEAR
10.11	SWITCHBOARD
10.12	PANELBOARDS
10.13	SUBSTATION
23.01	POTABLE WATER DISTRIBUTION SYSTEMS
23.02	NON-POTABLE WATER DISTRIBUTION SYSTEMS
23.04	SANITARY SEWER DISTRIBUTION SYSTEMS
23.05	CHILLED WATER DISTRIBUTION SYSTEMS - OVERHEAD
23.07	STEAM DISTRIBUTION SYSTEMS
23.08	STEAM CONDENSATE RETURN SYSTEMS
27.0	PETROLEUM FUEL FACILITIES

21.04 GRAVING DRYDOCKS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

The drydock entrance includes the exterior caisson wall, outer seal surfaces, harbor bottom, sluice gate, trash racks, underwater chambers and other components which require inspection on a biennial basis for the purpose of certification for use of the drydock. There is no Level I Inspection Method for inspecting the exterior of the drydock entrance. The Level III inspection should be conducted as described in the Level III Inspection Method Guide Sheet, Key No. 1.

COMPONENTS

◆ 21.04.01 CLOSURE WALLS - CONCRETE

Closure walls are heavy structures of reinforced concrete construction supported by wood, steel or concrete piles driven individually forming a vertical wall designed for the purpose of retaining earth and water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		2
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.01 CLOSURE WALLS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		3
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		3
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		3
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.01 CLOSURE WALLS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged water level indicators.**			
Observation:			
a. Damaged or missing numbers.	EA		
*** {Severity M}			
b. Corroded metal level indicator.	EA		
*** {Severity M}			
c. Damaged level indicator mounting bracket/bolts.	EA		
*** {Severity M}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.02 CLOSURE WALLS - STONE MASONRY (CYCLOPEAN WALLS)

Closure walls are heavy structures of stone masonry construction supported by wood, steel or concrete piles driven individually, forming a vertical wall designed for the purpose of retaining earth and water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective mortar.**			
Observation:			
a. Cracked joint material.	SF		
*** {Severity L}			
b. Loose/missing joint material.	SF		
*** {Severity H}			
*** Displacement of stones in wall surface.**			
Observation:			
a. Cracked or damaged stones.	SF		
*** {Severity M}			
b. Loose or missing stones.	SF		
*** {Severity H}			
*** Damaged water level indicators.**			
Observation:			
a. Damaged or missing numbers.	EA		
*** {Severity H}			
b. Corroded metal level indicator.	EA		
*** {Severity M}			
c. Damaged level indicator mounting bracket/bolts.	EA		
*** {Severity M}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.03 DECK/FLOOR SURFACES - CONCRETE

Graving drydock floor surfaces normally consist of reinforced concrete supported by steel, wood or concrete piles to provide a hard surface in order to accommodate operational requirements. Surfaces include drydock floor slabs, altar, tunnel, gallery and machinery room floor.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		4
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		4
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter or loss of more than 10 percent of concrete.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		5
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.03 DECK/FLOOR SURFACES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of course aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1"deep with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		5
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		5
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.04 CAISSONS

Caissons are entrance closures for graving drydocks. Most caissons in use today are usually welded steel, rectangular box, construction with hinges and wood bearings.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling steel members.**			
Observation:			
a. Deformation, twisting or bending.	EA		
*** {Severity L}			
b. Physically damaged members.	EA		
*** {Severity M}			
c. Stress or fatigue cracks.	EA		6
*** {Severity H}			
*** Connections of steel structural members.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		6
*** {Severity H}			
*** Leaking inner seal.**			
Observation:			
a. Water leaking less than or equal to 500 GAL/HR.	EA		
*** {Severity L}			
b. Water leaking greater than 500 GAL/HR.	EA		
*** {Severity H}			
*** Missing, broken or split wood bearing block.**			
Observation:			
a. Missing, broken or split members.	LF		
*** {Severity H}			
*** Excessive wood bearing block wear.**			
Observation:			
a. Thickness loss of more than 25 percent.	LF	1	
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.04 CAISSONS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Insect, rot or fungi damage to wood bearing block edges.**			
Observation:			
a. Insect infestation or decay of wood, indicated by any loss of material thickness.	EA	1	
*** {Severity H}			
*** Corrosion of metal surfaces.**			
Observation.			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Breakage, rutting, holes in caisson protective deck coating.**			
Observation:			
a. Width/diameter less than or equal to 1/2".	SF		
*** {Severity L}			
b. Width/diameter greater than 1/2" and less than or equal to 1".	SF		
*** {Severity M}			
c. Width/diameter greater than 1".	SF		
*** {Severity H}			
*** Weathering pattern cracking of caisson protective deck coating.**			
Observation:			
a. Cracks less than or equal to 1/16" wide.	SF		
*** {Severity L}			
b. Cracks greater than 1/16" and less than or equal to 1".	SF		
*** {Severity M}			
c. Cracks greater than 1/8" wide.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.04 CAISSONS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.05 SLUICE GATES

Sluice gates are usually installed below mean low water depth on each side of the graving dock entrance to control flooding of the drydock.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracking or buckling steel members of sluice gate.**			
Observation:			
a. Deformation, twisting or bending.	EA		
*** {Severity L}			
b. Physically damaged member.	EA		
*** {Severity M}			
* **Leaking sluice gate seals.**			
Observation:			
a. Grooved seals.	EA		
*** {Severity M}			
b. Deteriorated/pitted seals.	EA		
*** {Severity M}			
c. Physically damaged seals.	EA		
*** {Severity H}			
* **Corrosion of steel structural surfaces, sluice gate.**			
Observations:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.05 SLUICE GATES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated wedging devices, sluice gates.**			
Observation:			
a. Worn/damaged seating strips.	EA		
*** {Severity H}			
b. Corroded/worn wedge bolts.	EA		
*** {Severity H}			
*** Damaged sluice gate operating stems.**			
Observation:			
a. Corroded/worn stems.	EA		
*** {Severity H}			
b. Physically damaged/bent stems.	EA		
*** {Severity H}			
*** Defective trash racks/screens.**			
Observation:			
a. Surface fouled with solid material.	SF		
*** {Severity M}			
b. Deformation, twisting and bending.	SF		
*** {Severity H}			
c. Physically damaged member.	SF		
*** {Severity H}			
*** Corroded trash racks/screens.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective sluice gate vent gratings.**			
Observation:			
a. Loose grating.	EA		
*** {Severity L}			
b. Missing or damaged grating.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.06 FENDERS/CHAFING STRIPS

Wood or rubber fenders and chafing strips are installed to protect masonry structures and equipment at a dock entrance or a caisson berth against abrasion.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective fender.**			
Observation:			
a. Loose fender.	EA		
*** {Severity M}			
b. Missing or damaged fender.	EA		
*** {Severity H}			
*** Defective chafing strip.**			
Observation:			
a. Loose chafing strip.	EA		
*** {Severity M}			
b. Missing or damaged chafing strip.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.07 STAIR STRUCTURE - CONCRETE

Concrete stairs are usually cast-in-place as an integral part of the drydock wall. The treads should receive "non-slip" treatments and/or non-slip nosing of various materials. Beams and columns should be closely examined for structural cracks.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		7
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		7
*** {Severity H}			
Spalling.			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		8
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.07 STAIR STRUCTURE - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		8
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rust/discoloration evident, cracks occurring parallel to reinforcement.	SF		8
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Deterioration/damage of tread surface or nosing.**			
Observation:			
a. Non-slip treatments worn.	EA		
*** {Severity L}			
b. Nosing loose.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.08 STAIR STRUCTURE - METAL

Metal stairways are constructed of structural steel with open mesh or grating steel treads. Supports are generally bolted to the drydock walls to facilitate repair.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		9
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		9
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Cracking or scaling, of concrete.	EA		
*** {Severity L}			
b. Damaged or missing tread.	EA		
*** {Severity M}			
c. Damaged or missing grating.	EA		
*** {Severity H}			
*** Corrosion: frame/structure.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.09 LADDERS - METAL

Metal ladders installed within a drydock are strategically located to provide safe egress for climbing up or down to an otherwise inaccessible area. Ladders are provided only where the space is insufficient for stairways, or where traffic is too light to warrant stairway construction.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, anchors, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	2	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF	2	
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.10 CATWALKS/PLATFORMS - METAL

A steel catwalk or platform, to provide egress to an otherwise inaccessible area, usually for light traffic, consists of a metal frame with a metal plate or grate decking. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		10
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
b. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, anchors, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		10
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.10 CATWALKS/PLATFORMS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective coating covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.11 COPING - CONCRETE/GRANITE

A coping is a concrete or granite cap or flat cover over the closure walls of the drydock. The coping is normally sloped to shed water to protect the masonry below and to provide a working surface around the upper level of the drydock.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking, concrete deck surface or coping walls.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		11
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		11
*** {Severity H}			
*** Spalling, concrete deck surface or coping walls.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		12
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.11 COPING - CONCRETE/GRANITE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling, concrete deck surface or coping walls.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		11
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		12
*** {Severity H}			
*** Reinforcing steel corrosion, concrete deck surface or coping walls.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		12
*** {Severity H}			
*** Popouts, concrete deck surface or coping walls.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Displacement of granite stones.**			
Observation:			
a. Cracked or damaged stones.	SF		
*** {Severity M}			
b. Loose or missing stones.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.11 COPING - CONCRETE/GRANITE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective mortar.**			
Observation:			
a. Cracked or damaged stones.	SF		
*** {Severity L}			
b. Cracked joint material.	SF		
*** {Severity M}			
c. Loose/missing joint material.	SF		
*** {Severity H}			
*** Unevenness between deck sections.**			
Observation:			
a. Variation of concrete sections greater than 1/2".	SF		
*** {Severity H}			
*** Defective coping curbing.**			
Observation:			
a. Loose curbing sections.	LF		
*** {Severity L}			
b. Misalignment, difference in height greater than 1".	LF		
*** {Severity M}			
c. Spalling concrete sections.	LF		
*** {Severity H}			
d. Broken missing sections.	LF		
*** {Severity H}			
*** Defective coping marking plates.**			
Observation:			
a. Loose, damaged or missing marking plate.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.12 REMOVABLE CHAIN RAILINGS

A removable railing, consisting of two lines of zinc coated chains running through steel stanchions which are spaced at 8-foot intervals, are installed along the drydock coping or capstan pit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Damaged/missing railings.**			
Observations			
a. Bent stanchions.	EA		
*** {Severity M}			
b. Broken/missing/deteriorated chain.	LF		
*** {Severity H}			
c. Loose/broken stanchion sockets.	EA		
*** {Severity H}			
d. Missing or damaged stanchions.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.13 COLLECTOR CHANNEL/FLOODING CULVERT GRATING

Collector channels are wide, deep, grating covered, open floor culverts that direct water to the dewatering pump suction chamber for removal. Flooding culverts are used to flood a graving drydock with water prior to returning a ship or boat to service. Flooding culverts often serve in part as drainage or dewatering channels.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective culvert/channel gratings.**			
Observations			
a. Clogged openings.	EA		
*** {Severity L}			
b. Loose section of grating.	EA		
*** {Severity L}			
c. Damaged section of grating.	EA		
*** {Severity M}			
d. Missing section of grating.	EA		
*** {Severity H}			
*** Corrosion.**			
Observations:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.14 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail within a graving dock is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.15 MANHOLE AND CAPSTAN PIT COVERS - METAL

Metal manhole covers within graving docks cover manhole access passages.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective covers.**			
Observation:			
a. Loose hinge pins.	EA		
*** {Severity L}			
b. Bent, worn, or missing hinge pins.	EA		
*** {Severity M}			
c. Broken or missing covers.	EA		
*** {Severity H}			
* **Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.16 MARINE HARDWARE - METAL

Metal marine hardware fittings consist of bollards, bitts, cleats and chocks all strategically located along the coping and securely anchored to the structure to facilitate handling lines for vessel moving and drydock operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective marine hardware.**			
Observation:			
a. Rough or sharp line contact surfaces.	EA		
*** {Severity L}			
b. Loose, missing or defective bolts.	EA		
*** {Severity M}			
c. Worn, broken or missing.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.17 CAPSTAN ASSEMBLY

Motor operated capstans are installed on the coping at strategic locations for pulling vessels into the drydock chamber. Capstan driving mechanisms and foundations are located below coping elevation in concrete pits accessible through manholes, and an overall pit cover installed in sections to permit removal of machinery. Capstan motor control is performed via a typical motor assembly (motor, starter and disconnect).

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Stress cracks in capstan or housing.**			
Observation:			
a. Hairline crack(s).	EA		
*** {Severity M}			
b. Open cracks.	EA		
*** {Severity H}			
*** Damaged motor.**			
Observation:			
a. Cracked/damaged housing or end bells.	EA		
*** {Severity H}			
b. Broken motor base.	EA		
*** {Severity H}			
*** Missing, damaged or loose mounting hardware.**			
Observation:			
a. Loose mounting hardware.	EA		
*** {Severity F}			
b. Missing or damaged mounting hardware.	EA		
*** {Severity F}			
*** Excessive motor noise or vibration.**			
Observation:			
a. Rattling noise.	EA	3	13
*** {Severity M}			
b. Grinding noise, indicating metal to metal contact.	EA	3	13
*** {Severity H}			
c. Electrical arcing noise.	EA		14
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.17 CAPSTAN ASSEMBLY (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Inoperable controls.**			
Observation:			
a. Pressure limits are violated.	EA		
*** {Severity M}			
b. Broken electrical connections.	EA		
*** {Severity M}			
* **Defective control panel.**			
Observation:			
a. Burned out pilot lamps.	EA		
*** {Severity L}			
b. Physically damaged control panel enclosure.	EA		
*** {Severity M}			
c. Control panel blocked, not accessible for inspection.	EA		
*** {Severity S}			
* **Defective electrical connectors.**			
Observation:			
a. Loose conduit or connectors.	EA		
*** {Severity M}			
b. Exposed wires or missing cover plates.	EA		
*** {Severity H}			
* **Corroded motor housing.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.17 CAPSTAN ASSEMBLY (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corroded control panel.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective pit drainage system.**			
Observation:			
a. Drain line strainer stopped up.	EA		
*** {Severity L}			
b. Drain line strainer missing.	EA		
*** {Severity M}			
c. Drain line stopped up, water standing.	EA		
*** {Severity H}			
*** Damaged pit covers.**			
Observation:			
a. Physically damaged covers.	EA		
*** {Severity H}			
*** Corroded pit covers.**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.18 KEEL AND BILGE BLOCKS

Composite keel blocks (reinforced concrete with top and bottom timber caps) are placed under the longitudinal centerline keel of the vessel. The standard spacing is 6 feet center-to-center. Bilge or side blocks are timber, built up, shaped, and located according to dimensions on the vessels' docking plan. Both abovewater and underwater blocks shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Broken surface areas of keel concrete block.**			
Observation:			
a. Broken area of concrete block surface, not more than 1 SF or 2" deep.	SF		
*** {Severity L}			
b. Broken area of concrete block surface, more than 1 SF or 2" deep.	SF		
*** {Severity H}			
* **Missing, broken or split keel block timber caps or timber bilge blocks.**			
Observation:			
a. Missing, broken or split member.	SF		
*** {Severity H}			
* **Rot, fungus or decay of keel block timber caps or timber bilge blocks.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	4	
*** {Severity H}			
* **Parasite damage of keel block timber caps or timber bilge blocks.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	4	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	4	
*** {Severity H}			

21.04 GRAVING DRYDOCKS

COMPONENTS (Continued)

◆ 21.04.18 KEEL AND BILGE BLOCKS

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.04 GRAVING DRYDOCKS

REFERENCES

1. NAVFAC MO-322, Vol. 2, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

3. NAVFAC P-717.0, Department of Defense, Engineered Performance Standards for Real Property Maintenance Activities

21.04 GRAVING DRYDOCKS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.04.04-1
2	GS-II 21.04.09-2
3	GS-II 21.04.17-3
4	GS-II 21.04.18-4

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1*	GS-III 21.04.00-1*
2	GS-III 21.04.01-2
3	GS-III 21.04.01-3
4	GS-III 21.04.03-4
5	GS-III 21.04.03-5
6	GS-III 21.04.04-6
7	GS-III 21.04.07-7
8	GS-III 21.04.07-8
9	GS-III 21.04.08-9
10	GS-III 21.04.10-10
11	GS-III 21.04.11-11
12	GS-III 21.04.11-12
13	GS-III 21.04.17-13
14	GS-III 21.04.17-14

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: CAISSONS
CONTROL NUMBER: GS-II 21.04.04-1

Application

This guide applies to the investigation of possible deterioration of wood caisson bearing blocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean any marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers depth gauge and scales to determine an approximation of the thickness loss due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe the suspect areas of the block edges with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 21.04.09-2

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-II 21.04.17-3

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is 60 or greater.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing by outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Shut down motor, tag and lock out disconnect.
3. Check coupling for wear, damage or loose fasteners.
4. Visually check interior of motor housing for other physical damage, if an open motor.
5. Document the problem and contact appropriate facility personnel for further instructions, if defect cannot be determined or is major.
6. Notify appropriate facility personnel for permission to place unit back in service if defect is not critical to continued function.
7. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-II 21.04.17-3

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: KEEL AND BILGE BLOCKS - WOOD
CONTROL NUMBER: GS-II 21.04.18-4

Application

This guide applies to the investigation of possible deterioration of wood keel and bilge blocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean any marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1*

COMPONENT: DRYDOCK ENTRANCE - EXTERIOR
CONTROL NUMBER: GS-III 21.04.00-1*

Application

This guide applies to the underwater inspection of the exterior surfaces of the graving drydock for certification of the use of the drydock.

Special Safety Requirements:

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect outer caisson surfaces and outer seat for damage and deteriorated surfaces.
2. Inspect harbor bottom at drydock entrance for erosion of material.
3. Inspect sluice gate trash racks and underwater chambers for damage/ deteriorated surfaces.
4. Prepare written report of deficiencies for the Facilities Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Underwater Camera

Recommended Inspection Frequency

Biennially

References

1. NAVFAC DM 29.1, Graving Drydocks

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: CLOSURE WALLS - CONCRETE
CONTROL NUMBER: GS-III 02.04.01-2

Application

This guide applies to the investigation of cracks in concrete walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: CLOSURE WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.04.01-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: DECK/FLOOR SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.04.03-4

Application

This guide applies to the investigation of cracks in concrete deck/floor surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: DECK/FLOOR SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.04.03-5

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete floors/decks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: CAISSONS
CONTROL NUMBER: GS-III 21.04.04-6

Application

This guide applies to the investigation of cracks and cracked welds in structural steel members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: STAIR STRUCTURE - CONCRETE
CONTROL NUMBER: GS-III 21.04.07-7

Application

This guide applies to the investigation of cracks in concrete stairs.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: STAIR STRUCTURE - CONCRETE
CONTROL NUMBER: GS-III 21.04.07-8

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete stairs.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: STAIR STRUCTURE - METAL
CONTROL NUMBER: GS-III 21.04.08-9

Application

This guide applies to the investigation of cracks and cracked welds in metal stair structures.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: CATWALKS/PLATFORMS - METAL
CONTROL NUMBER: GS-III 21.04.10-10

Application

This guide applies to the investigation of cracks and cracked welds in steel or aluminum catwalk members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: COPING - CONCRETE/GRANITE
CONTROL NUMBER: GS-III 21.04.11-11

Application

This guide applies to the investigation of cracks in concrete/granite coping decks and concrete coping walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Check all sealant, expansion/contraction joints, or mortar joints for deterioration which will allow for water penetration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: COPING - CONCRETE/GRANITE
CONTROL NUMBER: GS-III 21.04.11-12

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete coping decks and walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-III 21.04.17-13

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is 60 or greater.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Perform vibration analysis on motor bearings.
3. Shut down motor, tag and lock out disconnect.
4. Rotate (cycle) motor to check for binding.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specifications.
6. Open and inspect motor interior housing for cracks, fatigue, erosion and corrosion, check suspicious areas with dye penetrant.
7. Check interior shafting for signs of fatigue or wear.
8. Rotate (cycle) shafting and check for distortion.
9. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
10. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
11. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13 (Continued)

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-III 21.04.17-13

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. Electric Motor and Contracting Co. Inc., Chesapeake, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-III 21.04.17-14

Application

This guide applies to the investigation of electrical arcing noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is 60 or greater.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Perform vibration analysis on the motor.
4. Rotate motor shaft and check for binding, rubbing.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specification.
6. Check alignment.
7. Shut down motor and lock out disconnect.
8. Open motor and inspect interior housing for stress cracks, corrosion, other physical damage, check suspicious areas with dye penetrant.
9. Check stator windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14 (Continued)

COMPONENT: CAPSTAN ASSEMBLY
CONTROL NUMBER: GS-III 21.04.17-14

Inspection Actions (Continued)

10. Check rotor windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
11. Check commutator/slip rings for loose parts, physical damage, wear.
12. Check brushes for wear, proper tension.
13. Check bearings for lube leakage into motor.
14. Check motor shafting for wear.
15. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
16. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
17. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Infrared Temperature Tester
4. Ammeter
5. Voltmeter
6. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

21.05 MARINE RAILWAYS

DESCRIPTION

Marine Railways is a subsystem of the Waterfront System. Marine railways may be either the endhaul or sidehaul type. Marine railways consist of inclined groundways that extend into the water, cradles that are moved on the groundway tracks, hoisting machinery, chains or cables for hauling the cradles out of or into the water, and elevated walkways to provide access to the vessel.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Marine Railways:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife
9. Dye, paintbrush, developer and rags

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Marine Railways, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.05.01 GROUNDWAYS - REINFORCED CONCRETE
- ◆ 21.05.02 CHAIN PATHS AND GUIDES
- ◆ 21.05.03 CRADLE TRACKS
- ◆ 21.05.04 CRADLE TRACK SUPPORTS - WOOD
- ◆ 21.05.05 CRADLE TRACK SUPPORTS - CONCRETE
- ◆ 21.05.06 CRADLE TRACK SUPPORTS - METAL
- ◆ 21.05.07 CRADLES
- ◆ 21.05.08 CRADLES WHEELS
- ◆ 21.05.09 CRADLE ROLLER TRAINS
- ◆ 21.05.10 CHAIN PULLS
- ◆ 21.05.11 KEEL AND BILGE BLOCKS
- ◆ 21.05.12 BOOT JACKS
- ◆ 21.05.13 DOCKING ASSEMBLY MOUNTING FRAMEWORK - WOOD
- ◆ 21.05.14 DOCKING ASSEMBLY MOUNTING FRAMEWORK - METAL

21.05 MARINE RAILWAYS

COMPONENT LIST (Continued)

- ◆ 21.05.15 DOCKING WINCH ASSEMBLY
- ◆ 21.05.16 WALKWAY FRAMING - WOOD
- ◆ 21.05.17 WALKWAY FRAMING - METAL
- ◆ 21.05.18 WALKWAY DECKING
- ◆ 21.05.19 HANDRAILS/GUARDRAILS - WOOD
- ◆ 21.05.20 HANDRAILS/GUARDRAILS - METAL
- ◆ 21.05.21 WALKWAY LADDERS - WOOD
- ◆ 21.05.22 WALKWAY LADDERS - METAL
- ◆ 21.05.23 WALKWAY DRAFT GAUGES - WOOD
- ◆ 21.05.24 WALKWAY DRAFT GAUGES - METAL
- ◆ 21.05.25 WALKWAY FENDERS AND FITTINGS
- ◆ 21.05.26 HAULING SYSTEM

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.02	WHARVES
21.03	PIERS
21.06	QUAYWALLS

21.05 MARINE RAILWAYS

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices

COMPONENTS

◆ 21.05.01 GROUNDWAYS - REINFORCED CONCRETE

A groundway is an inclined reinforced concrete slab on grade which extends into the water. Both above-water and underwater portions of the groundway shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	1	1
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	1	1
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.01 GROUNDWAYS - REINFORCED CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in dia.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	1	2
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	1	2
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF	1	2
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.01 GROUNDWAYS - REINFORCED CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.02 CHAIN PATHS AND GUIDES

Chain paths and guides are installed between the cradle tracks to contain the inhaul and outhaul chains. The paths and guides are constructed of treated or greenheart timber and lined with a steel wearing plate. Both above-water and underwater portions of the chain paths and guides shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	2	3
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	2	3
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	2	3
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.02 CHAIN PATHS AND GUIDES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged or loose timber connectors (hardwood dowels).**			
Observation:			
a. Loose connectors.	EA		
*** {Severity M}			
b. Broken, split, or rotted connectors.	EA		
*** {Severity H}			
c. Missing connectors.	EA		
*** {Severity H}			
*** Missing or damaged sections of chain path guide wearing plate.**			
Observation:			
a. Worn through section.	LF		
***{Severity M}			
b. Missing section.	LF		
*** {Severity H}			
*** Missing, damaged or loose wearing plate fasteners.**			
Observation:			
a. Loose fasteners.	EA		
*** {Severity L}			
b. Broken or missing fasteners.	EA		
*** {Severity M}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.03 CRADLE TRACKS

Navy marine railways usually have two steel rail cradle tracks. Three and four rail tracks may be used to increase support under the center of the cradle and keel of the vessel. Both above-water and underwater portions of the cradle track shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged cradle tracks.**			
Observation:			
a. Cracked, chipped section.	LF		
*** {Severity M}			
b. Broken, bent, or split section.	LF		
*** {Severity H}			
*** Defective joint bar or tie plate.**			
Observation:			
a. Loose joint bar or tie plate.	EA		
*** {Severity M}			
b. Missing or damaged joint bar or tie plate.	EA		
*** {Severity H}			
*** Defective bolts or spikes.**			
Observation:			
a. Loose bolts or spikes.	EA		
*** {Severity L}			
b. Missing or damaged bolts or spikes.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.03 CRADLE TRACKS

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.04 CRADLE TRACK SUPPORTS - WOOD

Groundways with the cradle tracks must be firmly supported by piles or concrete slabs on rocks and/or coral. Piles, pile bents, track stringers and other groundway structural members may be timber, concrete or steel. Both above-water and underwater visible portions of the wood piles and structural members shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 4, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split piles or members.**			
Observation:			
a. Missing, broken, or split pile or member.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage to piles or members.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	4	4
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	4	4
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	4	4
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.05 CRADLE TRACK SUPPORTS - CONCRETE

Groundways with the cradle tracks must be firmly supported by piles or concrete slabs on rocks and/or coral. Piles, pile bents, track stringers and other groundway structural members may be timber, concrete or steel. Both above-water and underwater visible portions of concrete piles and structural members shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 5, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles or members.**			
Observation:			
a. Missing, broken or fractured pile or member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	5	5
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	5	5
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.05 CRADLE TRACK SUPPORTS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in dia.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	5	6
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	5	6
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	5	6
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.06 CRADLE TRACK SUPPORTS - STEEL

Groundways with the cradle tracks must be firmly supported by piles or concrete slabs on rocks and/or coral. Piles, pile bents, track stringers and other groundway structural members may be timber, concrete or steel. Both above-water and underwater visible portions of steel piles shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 6, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	6	7
*** {Severity H}			
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	6	7
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ **21.05.06 CRADLE TRACK SUPPORTS - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent.	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.07 CRADLES

Most cradles designed to support the vessel on tracks have steel frames with wood or steel decking; however, timber cradles may be used for designs of small capacity. Cradle wheels or roller trains support and allow movement of the cradle. Both above-water and underwater sections of the cradles shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheets, Keys No. 7 and 8, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel frame members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling of steel frame or deck members.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	7	
*** {Severity H}			
*** Corrosion of steel frame or deck members.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.07 CRADLES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage of steel frame or deck members.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA	7	
*** {Severity H}			
*** Deteriorated protective covering of steel frame or deck members.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Split, cracked, broken, or missing wood frame or deck members.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	8	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.07 CRADLES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Parasite damage of wood frame or deck members.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	8	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	8	
*** {Severity H}			
* **Defective connectors/anchorage of wood frame or deck members.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.08 CRADLE WHEELS

A system of wheels is attached to the cradle and rolls on the cradle tracks. Both above-water and underwater cradle wheels shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 9, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken, cracked, or chipped cradle wheels.**			
Observation:			
a. Cracked or chipped wheel.	EA		
*** {Severity M}			
b. Missing or broken wheel.	EA		
*** {Severity H}			
*** Misaligned or loose wheels.**			
Observation:			
a. Misaligned or loose wheel.	EA		
*** {Severity M}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.09 CRADLE ROLLER TRAINS

Steel rollers are assembled in sections or nests and held in place by frames that are spliced together to form one continuous roller train. The steel frame is provided with a cast iron plow at the off shore end of the train to clear the tracks of obstructions. Both above-water and underwater roller train sections shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 10, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Broken, cracked or chipped train rollers.**			
Observation:			
a. Cracked or chipped roller.	EA		
*** {Severity M}			
b. Broken roller.	EA		
*** {Severity H}			
* **Misaligned or loose rollers.**			
Observation:			
a. Misaligned or loose roller.	EA		
*** {Severity M}			
* **Misaligned or bent roller train frame sections.**			
Observation:			
a. Misaligned or bent frame section.	EA		
*** {Severity H}			
* **Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.09 CRADLE ROLLER TRAINS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	10	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.10 CHAIN PULLS

Steel chain pulls with sheaves are attached to the cradle crossarm at each end of the cradle. The chain pulls must be designed to support the maximum pull of the inhaul and outhaul chains. Both above-water and underwater chain pulls shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 11, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or cracked chain pull frame member or sheave.**			
Observation:			
a. Missing, broken or cracked frame member or sheave.	EA		
*** {Severity H}			
*** Loose or misaligned chain pull frame member or sheave.**			
Observation:			
a. Loose or misaligned frame member or sheave.	EA		
*** {Severity M}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.11 KEEL AND BILGE BLOCKS

Composite keel blocks (reinforced concrete with top and bottom timber caps) are placed under the longitudinal centerline keel of the vessel. The standard spacing is 6 feet center-to-center. Bilge or side blocks are timber, built up, shaped, and located according to dimensions on the vessels' docking plan. Both above-water and underwater blocks shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 12, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Broken surface areas of keel concrete block.**			
Observation:			
a. Broken area of concrete block surface, not more than 1 SF or 2" deep.	SF		
*** {Severity L}			
d. Broken area of concrete block surface, more than 1 SF or 2" deep.	SF		
*** {Severity H}			
*** Missing, broken or split keel block timber caps or timber bilge blocks.**			
Observation:			
c. Missing, broken or split member.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	12	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.11 KEEL AND BILGE BLOCKS

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Parasite damage of keel block timber caps or timber bilge blocks.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	12	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	12	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Missing, loose or damaged lifting ring.**			
Observation:			
a. Bent or cracked lifting ring.	EA		
*** {Severity M}			
b. Missing or loose lifting ring.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.12 BOOT JACKS

A boot jack is a steel A-frame mounted on the inner end of the cradle for use in lining up the bow of the ship over the cradle preparatory to hauling.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.13 DOCKING ASSEMBLY MOUNTING FRAMEWORK - WOOD

A motor operated winch may be installed on the shore end of the cradle centerline to haul in the vessels. Special framework is required for mounting the winch at the walkway level. To avoid loss of docking length, an alternative arrangement would provide two winches, one on each side of the cradle superstructure.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing mounting framework member.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	13	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	13	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	13	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.13 DOCKING ASSEMBLY MOUNTING FRAMEWORK - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.14 DOCKING ASSEMBLY MOUNTING FRAMEWORK - METAL

A motor operated winch may be installed on the shore end of the cradle centerline to haul in the vessels. Special framework is required for mounting the winch at the walkway level. To avoid loss of docking length, an alternative arrangement would provide two winches, one on each side of the cradle superstructure.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	14	
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA	14	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.15 DOCKING WINCH ASSEMBLY

A winch is installed on the shore end of the cradle centerline and is used to haul in the vessels.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Stress cracks in winch or motor housing.**			
Observation:			
a. Hairline crack(s).	EA		
*** {Severity M}			
b. Open crack(s).	EA		
*** {Severity H}			
*** Missing, damaged or loose mounting hardware.**			
Observation:			
a. Loose mounting hardware.	EA		
*** {Severity F}			
b. Missing or damaged mounting hardware.	EA		
*** {Severity F}			
*** Leaking bearing seals.**			
Observation:			
a. Leaking bearing seals.	EA		
*** {Severity M}			
*** Damaged motor.**			
Observation:			
a. Cracked/damaged housing or end bells.	EA		
*** {Severity M}			
b. Broken motor base.	EA		
*** {Severity H}			
*** Excessive motor noise or vibration.**			
Observation:			
a. Rattling noise.	EA	15	8
*** {Severity M}			
b. Grinding noise, indicating metal to metal contact.	EA	15	8
*** {Severity H}			
c. Electrical arcing noise.	EA		9
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ **21.05.15 DOCKING WINCH ASSEMBLY (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective electrical connectors.**			
Observation:			
a. Loose conduit or connectors.	EA		
*** {Severity M}			
b. Exposed wires or missing cover plates.	EA		
*** {Severity H}			
*** Inoperable controls.**			
Observation:			
a. Pressure limits are violated.	EA		
*** {Severity M}			
b. Broken electrical connections.	EA		
*** {Severity M}			
*** Defective control panel.**			
Observation:			
a. Burned out pilot lamps.	EA		
*** {Severity L}			
b. Physically damaged control panel enclosure.	EA		
*** {Severity M}			
c. Control panel blocked, not accessible for inspection.	EA		
*** {Severity S}			
*** Excessive noise from control panel.**			
Observation:			
a. Electrical arcing noise.	EA		10
*** {Severity M}			
*** Defective cable.**			
Observation:			
a. Broken, kinked or frayed hauling cable.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ **21.05.15 DOCKING WINCH ASSEMBLY (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corroded cable.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Corroded winch, motor or control housing.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.16 WALKWAY FRAMING - WOOD

Walkway framing of timber may support the walkways and form the sides and shore end of the cradle.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing framing member.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	16	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	16	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	16	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.16 WALKWAY FRAMING - WOOD

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.17 WALKWAY FRAMING - METAL

Walkway framing of steel may support the walkways and form the sides and shore end of the cradle.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	17	
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA	17	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.18 WALKWAY DECKING

Level, timber decked walkways, about 3 feet wide, should be at such an elevation that there is adequate freeboard when the cradle is in its extreme offshore position.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing decking.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	18	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	18	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	18	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.19 HANDRAILS/GUARDRAILS - WOOD

A wood handrail or guardrail on the marine railway is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	19	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	19	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	19	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.20 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail on the marine railway is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.21 WALKWAY LADDERS - WOOD

Wood ladders on the marine railway are strategically located to provide safe egress for climbing up or down from the cradle floor to the inboard side of the walkway. Wooden ladders are typically constructed with side rails of 2" nominal thickness and rungs of 1 5/32" diameter. The wooden rungs may be reinforced with steel rods.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Split, cracked or broken members.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged, broken or deflected.	LF		
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	20	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.21 WALKWAY LADDERS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	20	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, crushing.	LF	20	
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.22 WALKWAY LADDERS - METAL

Metal ladders on the marine railway are strategically located to provide safe egress for climbing up or down from the cradle floor to the inboard side of the walkway. A steel ladder typically is 18" wide with 3/4" diameter rungs spaced 12" on-center and wall brackets maintaining a 7" clearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolt rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	21	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF	21	
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.23 WALKWAY DRAFT GAUGES - WOOD

Wood draft gauges, as necessary are provided on the sides of the walkway.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged, broken or loose draft gauge.**			
Observation:			
a. Loose section.	EA		
*** {Severity L}			
b. Missing, damaged or broken section.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF		
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF		
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF		
*** {Severity H}			
*** Illegible markings.**			
Observation:			
a. Illegible markings.	EA		
*** {Severity M}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.24 WALKWAY DRAFT GAUGES - METAL

Steel draft gauges, as necessary are provided on the sides of the walkway.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged, bent or loose draft gauge.**			
Observation:			
a. Loose section.	EA		
*** {Severity L}			
b. Missing, damaged or bent section.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Illegible markings.**			
Observation:			
a. Illegible markings.	EA		
*** {Severity M}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.25 WALKWAY FENDERS AND FITTINGS

Fenders, usually of wood, rubber, vinyl or rope are installed on the inboard side of the walkway to prevent damage to the vessel or walkway. Steel cleats, ring bolts and chocks are installed on the inboard side of the walkway for securing the vessel's lines.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective fenders.**			
Observation:			
a. Loose fenders.	EA		
*** {Severity M}			
b. Missing or damaged fenders.	EA		
*** {Severity H}			
*** Defective cleats, ring bolts or chocks.**			
Observation:			
a. Loose fitting.	EA		
*** {Severity M}			
b. Missing or broken fitting.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.26 HAULING SYSTEM

The hauling system includes the equipment and steel chains used to move the cradle with its walkway between the outboard and inboard positions. The chains connect the cradle to the inshore hoist. The shackles with inboard and outboard sheaves enable the reeving system to be laid out in the form of a closed system. Inhaul and outhaul chains pass over wildcats or sprockets. The wildcats or sprockets are mounted on the hoist shaft and turned by a gear train directly connected to the hoist motor.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective chains.**			
Observation:			
a. Worn chain line, cross section loss greater than 10 percent.	EA		
*** {Severity H}			
b. Broken or cracked chain link.	EA		
*** {Severity H}			
*** Defective sheaves or shackles.**			
Observation:			
a. Loose or misaligned sheaves or shackles.	EA		
*** {Severity M}			
b. Broken or cracked sheaves or shackles.	EA		
*** {Severity H}			
*** Corrosion damaged sheaves or shackles.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering of section.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal of section.	EA		
*** {Severity H}			
*** Defective hoist housing, wildcats or sprockets.**			
Observation:			
a. Hairline crack(s).	EA		
*** {Severity M}			
b. Open crack(s).	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.26 HAULING SYSTEM (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective mounting or connecting fasteners.**			
Observation:			
a. Loose fasteners.	EA		
*** {Severity F}			
b. Missing or damaged fastener.	EA		
*** {Severity F}			
*** Defective hoist controls.**			
Observation:			
a. Missing or inoperable controls.	EA		
*** {Severity H}			
*** Leaking or dry hoist bearing seals.**			
Observation:			
a. Leaking bearing seals.	EA		
*** {Severity M}			
b. Dry bearing seals.	EA		
*** {Severity H}			
*** Corroded hoist housing, wildcat or sprocket.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering of section.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal of section.	EA		
*** {Severity H}			
*** Damaged motor.**			
Observation:			
a. Cracked/damaged housing or end bells.	EA		
*** {Severity M}			
b. Broken motor base.	EA		
*** {Severity H}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ **21.05.26 HAULING SYSTEM (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Excessive motor noise or vibration.**			
Observation:			
a. Rattling noise.	EA	22	11
*** {Severity M}			
b. Grinding noise, indicating metal to metal contact.	EA	22	11
*** {Severity H}			
c. Electrical arcing noise.	EA		12
*** {Severity H}			
*** Defective electrical connectors.**			
Observation:			
a. Loose conduit or connectors.	EA		
*** {Severity M}			
b. Exposed wires or missing cover plates.	EA		
*** {Severity H}			
*** Corroded motor housing.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity}			
*** Defective control panel.**			
Observation:			
a. Burned out pilot lamps.	EA		
*** {Severity L}			
b. Physically damaged control panel enclosure.	EA		
*** {Severity M}			
c. Control panel blocked, not accessible for inspection.	EA		
*** {Severity S}			

21.05 MARINE RAILWAYS

COMPONENTS (Continued)

◆ 21.05.26 HAULING SYSTEM (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Excessive noise from control panel.**			
Observation:			
a. Electrical arcing noise.	EA		14
*** {Severity M}			
*** Corroded control panel.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

21.05 MARINE RAILWAYS

REFERENCES

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-322, Vol.I and II, Inspection or Shore Facilities, 1993

3. NAVFAC DM-25, Waterfront Operational Facilities

4. NAVDOCKS P-272, Part 1, Vol.I, Definitive Designs for Shore Facilities

5. NAVFAC DM-29.2, Marine Railways, 1981

6. NAVFAC DM-29.1, Graving Drydocks, 1982

7. U.S. Department of Transportation; Bridge Inspector's Training Manual/1990, PB92-171883

21.05 MARINE RAILWAYS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.05.01-1
2	GS-II 21.05.02-2
3	GS-II 21.05.03-3
4	GS-II 21.05.04-4
5	GS-II 21.05.05-5
6	GS-II 21.05.06-6
7	GS-II 21.05.07-7
8	GS-II 21.05.07-8
9	GS-II 21.05.08-9
10	GS-II 21.05.09-10
11	GS-II 21.05.10-11
12	GS-II 21.05.11-12
13	GS-II 21.05.13-13
14	GS-II 21.05.14-14
15	GS-II 21.05.15-15
16	GS-II 21.05.16-16
17	GS-II 21.05.17-17
18	GS-II 21.05.18-18
19	GS-II 21.05.19-19
20	GS-II 21.05.21-20
21	GS-II 21.05.22-21
22	GS-II 21.05.26-22

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.05.01-1
2	GS-III 21.05.01-2
3	GS-III 21.05.02-3
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10	GS-III 21.05.15-10
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12	GS-III 21.05.26-12
13*	GS-III 21.05.26-13*
14	GS-III 21.05.26-14

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: GROUNDWAYS - REINFORCED CONCRETE
CONTROL NUMBER: GS-II 21.05.01-1

Application

This guide applies to the investigation of possible deterioration of reinforced concrete groundways.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the groundway exterior with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: CHAIN PATHS AND GUIDES - WOOD
CONTROL NUMBER: GS-II 21.05.02-2

Application

This guide applies to the investigation of possible deterioration of wood chain paths and guides due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

1. Clean any marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the wood exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: CRADLE TRACKS
CONTROL NUMBER: GS-II 21.05.03-3

Application

This guide applies to the investigation of possible damage or deterioration of steel rail cradle tracks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers and scales to determine surface area affected by deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: CRADLE TRACK SUPPORTS - WOOD
CONTROL NUMBER: GS-II 21.05.04-4

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles and structural members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: CRADLE TRACK SUPPORTS - CONCRETE
CONTROL NUMBER: GS-II 21.05.05-5

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles and structural members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: CRADLE TRACK SUPPORTS - METAL
CONTROL NUMBER: GS-II 21.05.06-6

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of steel piles and structural members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: CRADLES
CONTROL NUMBER: GS-II 21.05.07-7

Application

This guide applies to the investigation of possible damage or deterioration of metal cradle frames and decking.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. For above-water sections, clean area (wire brush) to bare metal.
2. Apply dye on clean areas, allow to penetrate, remove excess.
3. Apply developer on these areas, this draws the dye out and defines the extent and size of surface flaws.
4. For underwater sections, clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
5. Utilize calipers and scales to determine surface area affected by deterioration.
6. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

2. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

3. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

4. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities,1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: CRADLES
CONTROL NUMBER: GS-II 21.05.07-8

Application

This guide applies to the investigation of deterioration of wood decking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: CRADLE WHEELS
CONTROL NUMBER: GS-II 21.05.08-9

Application

This guide applies to the investigation of possible damage or deterioration of steel cradle wheels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 10

COMPONENT: CRADLE ROLLER TRAINS
CONTROL NUMBER: GS-II 21.05.09-10

Application

This guide applies to the investigation of possible damage or deterioration of metal cradle roller train frames.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. For above-water sections, clean area (wire brush) to bare metal.
2. Apply dye on clean areas, allow to penetrate, remove excess.
3. Apply developer on these areas, this draws the dye out and defines the extent and size of surface flaws.
4. For underwater sections, clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
5. Utilize calipers and scales to determine surface area affected by deterioration.
6. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

2. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

3. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

4. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 11

COMPONENT: CHAIN PULLS
CONTROL NUMBER: GS-II 21.05.10-11

Application

This guide applies to the investigation of possible damage or deterioration of steel chain pulls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 12

COMPONENT: KEEL AND BILGE BLOCKS
CONTROL NUMBER: GS-II 21.05.11-12

Application

This guide applies to the investigation of possible deterioration of wood keel and bilge blocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the block exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 13

COMPONENT: DOCKING ASSEMBLY MOUNTING FRAMEWORK - WOOD
CONTROL NUMBER: GS-II 21.05.13-13

Application

This guide applies to the investigation of deterioration of wood docking assembly mounting framework due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 14

COMPONENT: DOCKING ASSEMBLY MOUNTING FRAMEWORK - METAL
CONTROL NUMBER: GS-II 21.05.14-14

Application

This guide applies to the investigation of cracks or cracked welds in metal docking assembly mounting framework.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 15

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-II 21.05.15-15

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing by outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Shut down motor, tag and lock out disconnect.
3. Check coupling for wear, damage or loose fasteners.
4. Visually check interior of motor housing for other physical damage, if an open motor.
5. Document the problem and contact appropriate facility personnel for further instructions, if defect cannot be determined or is major.
6. Notify appropriate facility personnel for permission to place unit back in service if defect is not critical to continued function.
7. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 15 (Continued)

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-II 21.05.15-16

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, I988

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 16

COMPONENT: WALKWAY FRAMING - WOOD
CONTROL NUMBER: GS-II 21.05.16-16

Application

This guide applies to the investigation of deterioration of wood walkway framing due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 17

COMPONENT: WALKWAY FRAMING - METAL
CONTROL NUMBER: GS-II 21.05.17-17

Application

This guide applies to the investigation of cracks or cracked welds in metal walkway framing.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 18

COMPONENT: WALKWAY DECKING
CONTROL NUMBER: GS-II 21.05.18-18

Application

This guide applies to the investigation of deterioration of wood decking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 19

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 21.05.19-19

Application

This guide applies to the investigation of deterioration of wood handrail/guardrail members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 20

COMPONENT: WALKWAY LADDERS- WOOD
CONTROL NUMBER: GS-II 21.05.21-20

Application

This guide applies to the investigation of deterioration of wood ladders due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 21

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 21.05.22-21

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 22

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-II 21.05.26-22

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing by outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Shut down motor, tag and lock out disconnect.
3. Check coupling for wear, damage or loose fasteners.
4. Visually check interior of motor housing for other physical damage, if an open motor.
5. Document the problem and contact appropriate facility personnel for further instructions, if defect cannot be determined or is major.
6. Notify appropriate facility personnel for permission to place unit back in service if defect is not critical to continued function.
7. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other factors such as problematic conditions.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 22 (Continued)

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-II 21.05.26-22

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: GROUNDWAYS - REINFORCED CONCRETE
CONTROL NUMBER: GS-III 21.05.01-1

Application

This guide applies to the investigation of cracks in concrete groundways.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: GROUNDWAYS - REINFORCED CONCRETE
CONTROL NUMBER: GS-III 21.05.01-2

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete groundways.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: GROUNDWAYS - REINFORCED CONCRETE
CONTROL NUMBER: GS-III 21.05.01-2

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: CHAIN PATHS AND GUIDES
CONTROL NUMBER: GS-III 21.05.02-3

Application

This guide applies to the investigation of deterioration of wood chain paths and guides due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: CRADLE TRACK SUPPORTS - WOOD
CONTROL NUMBER: GS-III 21.05.04-4

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles and structural members due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: CRADLE TRACK SUPPORTS - WOOD
CONTROL NUMBER: GS-III 21.05.04-4

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: CRADLE TRACK SUPPORTS - CONCRETE
CONTROL NUMBER: GS-III 21.05.05-5

Application

This guide applies to the investigation of cracks in concrete piles and structural members.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: CRADLE TRACK SUPPORTS - CONCRETE
CONTROL NUMBER: GS-III 21.05.05-5

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: CRADLE TRACK SUPPORTS - CONCRETE
CONTROL NUMBER: GS-III 21.05.05-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles and structural members.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: CRADLE TRACK SUPPORTS - CONCRETE
CONTROL NUMBER: GS-III 21.05.05-6

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: CRADLE TRACK SUPPORTS - METAL
CONTROL NUMBER: GS-III 21.05.06-7

Application

This guide applies to the investigation of cracks and cracked welds in steel piles and structural members.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from suspected area using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Inspect extent of deformation for cracks.
3. Perform ultrasonic pulse velocity test to determine degree of cracking.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: CRADLE TRACK SUPPORTS - METAL
CONTROL NUMBER: GS-III 21.05.06-7

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-8

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Perform vibration analysis on motor bearings.
3. Shut down motor, tag and lock out disconnect.
4. Rotate (cycle) motor to check for binding.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specifications.
6. Open and inspect motor interior housing for cracks, fatigue, erosion and corrosion, check suspicious areas with dye penetrant.
7. Check interior shafting for signs of fatigue or wear.
8. Rotate (cycle) shafting and check for distortion.
9. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
10. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
11. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-8

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-9

Application

This guide applies to the investigation of electrical arcing noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Perform vibration analysis on the motor.
4. Rotate motor shaft and check for binding, rubbing.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specification.
6. Check alignment.
7. Shut down motor and lock out disconnect.
8. Open motor and inspect interior housing for stress cracks, corrosion, other physical damage, check suspicious areas with dye penetrant.
9. Check stator windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
10. Check rotor windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
11. Check commutator/slip rings for loose parts, physical damage, wear.
12. Check brushes for wear, proper tension.
13. Check bearings for lube leakage into motor.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-9

Inspection Actions (Continued)

14. Check motor shafting for wear.
15. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
16. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
17. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Infrared Temperature Tester
4. Ammeter
5. Voltmeter
6. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-10

Application

This guide applies to the investigation of electrical arcing noise from the controls of the docking winch assembly.

For controls in general use, Level I, II and/or III inspection methods will apply.

The Facility Manager will specify the level of inspection required for specialized control applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.

Inspection Actions

1. Observe control operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Open and inspect local disconnect. Check for proper tension on blade-type disconnect switch, good blade alignment, signs of overheating.
4. Open and inspect motor starter. Check for contacts for pitting, good alignment, smooth action, signs of overheating.
5. Check wiring in disconnect and starter for worn, frayed insulation, loose connections.
6. Document the problem and contact appropriate facility personnel for further instructions and reassemble control, if directed.
7. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
8. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, required to perform the inspection of the subsystem:

1. Infrared Temperature Tester
2. Ammeter
3. Voltmeter

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: DOCKING WINCH ASSEMBLY
CONTROL NUMBER: GS-III 21.05.15-10

Recommended Inspection Frequency

Perform inspection when triggered by Level I, Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

2. Electric Motor & Contracting Co. Inc., Chesapeake, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-11

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the motor of the hauling system.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Perform vibration analysis on motor bearings.
3. Shut down motor, tag and lock out disconnect.
4. Rotate (cycle) motor to check for binding.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specifications.
6. Open and inspect motor interior housing for cracks, fatigue, erosion and corrosion, check suspicious areas with dye penetrant.
7. Check interior shafting for signs of fatigue or wear.
8. Rotate (cycle) shafting and check for distortion.
9. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
10. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
11. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-11

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I, Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. Electric Motor & Contracting Co. Inc., Chesapeake, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-12

Application

This guide applies to the investigation of electrical arcing noise from the motor of the hauling system.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Always have one person standing outside when someone is working inside a walk-in unit.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Perform vibration analysis on the motor.
4. Rotate motor shaft and check for binding, rubbing.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specification.
6. Check alignment.
7. Shut down motor and lock out disconnect.
8. Open motor and inspect interior housing for stress cracks, corrosion, other physical damage, check suspicious areas with dye penetrant.
9. Check stator windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
10. Check rotor windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
11. Check commutator/slip rings for loose parts, physical damage, wear.
12. Check brushes for wear, proper tension.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12 (Continued)

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-12

Inspection Actions (Continued)

13. Check bearings for lube leakage into motor.
14. Check motor shafting for wear.
15. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
16. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
17. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Infrared Temperature Tester
4. Ammeter
5. Voltmeter
6. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I, Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. Electric Motor & Contracting Co. Inc., Chesapeake, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13*

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-13*

Application

This guide applies to checking the windings of electric motors for open circuits, grounds or deteriorated insulation. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.
2. Large electrical equipment such as motors above 500 HP usually have sufficient capacitance to store a dangerous amount of energy from the test current. Make sure this capacitance is discharged after each test and before handling the test leads.
3. Do not use this type of instrument in an explosive atmosphere.

Inspection Actions

1. Check line voltage and ampere load for proper balance.
2. Shut down motor, tag and lockout disconnect.
3. Remove the three phase leads (load conductors) at the motor terminals or at the starter. If leads are removed at the motor, tape conductor ends. Mark leads.
4. Perform grounding and dielectric resistance test on motor windings. Valves below 50 Megohms at an ambient temperature of 85 degrees F or less may indicate the presence of moisture in the winding insulation.
5. Document readings and contact appropriate facility personnel if the readings indicate a suspected problem.
6. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
7. Make sure that leads are connected and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Megohmmeter

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13* (Continued)

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-13*

Recommended Inspection Frequency

Annually

References

1. The Locomotive, Vol. 66, Spring 1994, The Hartford Steam Boiler Inspection and Insurance Co., Inc.

2. Institute of Electrical and Electronic Engineers (IEEE), Specifications 112 (1984), 113 (1985) and 115 (1983)

3. National Electrical Manufacturers' Association (NEMA) Book, MG 1-987, Part 12 (1987)

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-14

Application

This guide applies to the investigation of electrical arcing noise from the controls or control panel.

For controls in general use, Level I, II and/or III inspection methods will apply.

The Facility Manager will specify the level of inspection required for specialized control applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.

Inspection Actions

1. Observe control operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Open and inspect local disconnect. Check for proper tension on blade-type disconnect switch, good blade alignment, signs of overheating.
4. Open and inspect motor starter. Check for contacts for pitting, good alignment, smooth action, signs of overheating.
5. Check wiring in disconnect and starter for worn, frayed insulation, loose connections.
6. Document the problem and contact appropriate facility personnel for further instructions and reassemble control, if directed.
7. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
8. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of the subsystem:

1. Infrared Temperature Tester
2. Ammeter
3. Voltmeter

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14 (Continued)

COMPONENT: HAULING SYSTEM
CONTROL NUMBER: GS-III 21.05.26-14

Recommended Inspection Frequency

Perform inspection when triggered by Level I, Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

2. Electric Motor & Contracting Co. Inc., Chesapeake, Virginia

21.06 QUAYWALLS

DESCRIPTION

Quaywalls is a subsystem of the Waterfront System. A quaywall is a heavy gravity or platform structure fronting navigable water and parallel to the shore. Its function is to act as a bulkhead to support an embankment, to provide for berthing of vessels or other services.

Quaywall Types:

a. Platform with curtain wall
b. Platform with/without relieving platform
c. Bulkhead and relieving platform
d. Sheet pile cellular design
e. Cyclopean concrete

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Quaywalls:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife
9. Dye, paintbrush, developer and rags

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Quaywalls, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

21.06 QUAYWALLS

COMPONENT LIST

- 21.06.01 PILES - WOOD
- 21.06.02 PILES - CONCRETE
- 21.06.03 PILES - METAL
- 21.06.04 PILE CAPS - WOOD
- 21.06.05 PILE CAPS - CONCRETE
- 21.06.06 PILE CAPS - METAL
- 21.06.07 BULKHEADS - WOOD
- 21.06.08 BULKHEADS - CONCRETE
- 21.06.09 BULKHEADS - METAL
- 21.06.10 BULKHEADS - STONE MASONRY (CYCLOPEAN WALLS)
- 21.06.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL
- 21.06.12 PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD
- 21.06.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL
- 21.06.14 DECK SURFACES - WOOD
- 21.06.15 DECK SURFACES - CONCRETE
- 21.06.16 DECK SURFACES - METAL
- 21.06.17 HANDRAILS/GUARDRAILS - WOOD
- 21.06.18 HANDRAILS/GUARDRAILS - CONCRETE
- 21.06.19 HANDRAILS/GUARDRAILS - METAL
- 21.06.20 CATWALKS - WOOD
- 21.06.21 CATWALKS - METAL
- 21.06.22 LADDERS - WOOD
- 21.06.23 LADDERS - METAL
- 21.06.24 DECK CURBING - WOOD
- 21.06.25 DECK CURBING - CONCRETE
- 21.06.26 DECK CURBING - METAL
- 21.06.27 DECK SCUPPERS AND DRAINS - CONCRETE
- 21.06.28 DECK SCUPPERS AND DRAINS - METAL
- 21.06.29 MANHOLE COVERS - METAL
- 21.06.30 MARINE HARDWARE - METAL
- 21.06.31 FIREWALL PARTITIONS - WOOD
- 21.06.32 FIREWALL PARTITIONS - CONCRETE
- 21.06.33 FIREWALL PARTITIONS - METAL
- 21.06.34 STRUCTURAL FRAME MEMBERS - WOOD
- 21.06.35 STRUCTURAL FRAME MEMBERS - CONCRETE
- 21.06.36 STRUCTURAL FRAME MEMBERS - METAL
- 21.06.37 ROCK DIKES
- 21.06.38 RIPRAP
- 21.06.39 HARBOR BOTTOM

21.06 QUAYWALLS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.01	DOLPHINS
21.02	WHARVES
21.03	PIERS
21.07	JETTIES
21.08	BREAKWATERS
21.09	GROINS
21.10	SEAWALLS
21.11	WATERFRONT SPECIALTIES

21.06 QUAYWALLS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.06.01 PILES - WOOD

A wood pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support a vertical load or to resist lateral forces and support quaywall structures. For observations involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
* **Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.01 PILES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.02 PILES - CONCRETE

A concrete pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. Both above-water and underwater portions of the pile shall be inspected. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles.**			
Observation:			
a. Missing, broken or fractured piles.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	2	2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	2	2
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in dia.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	2	3
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	2	3
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	2	3
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.02** **PILES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.03 PILES - METAL

A metal pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or resist lateral forces, it is usually less than 24" in diameter. In underpinning, piles are most commonly composed of steel cylinders from 12" to 24" in diameter and filled with concrete. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent.	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	3	4
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.03 PILES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	3	4
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.04 PILE CAPS - WOOD

A wood pile cap is connecting beams which covers the heads of a group of piles tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose pile caps.**			
Observation:			
a. Loose pile cap.	EA		
*** {Severity M}			
b. Missing pile cap.	EA		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically damaged or broken.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	4	5
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	4	5
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	4	5
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.05 PILE CAPS - CONCRETE

A concrete pile cap is a slab or connecting beam which covers the heads of a group of piles tying them together so that the structural load is distributed and they act as a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, damaged or loose pile caps.**			
Observation:			
a. Physically loose pile cap.	EA		
*** {Severity M}			
b. Missing or damaged pile cap.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		6
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		6
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		7
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.05** **PILE CAPS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		7
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		7
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.06 PILE CAPS - METAL

A metal pile cap is a plate or connecting beam which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act like a single unit.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, cracked or buckled pile cap.**			
Observation:			
a. Cracked or buckled pile cap.	LF		8
*** {Severity H}			
b. Missing pile cap.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		8
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.07 BULKHEADS - WOOD

A wood bulkhead is constructed of interlocking wood members driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 5, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Missing, broken or split member.**			
Observation:			
a. Missing, broken, or split member.	SF		
*** {Severity H}			
* **Rot, fungus or decay.**			
Observation:			
a. Moist, stained area.	SF		
*** {Severity M}			
b. Discolored, soft, crushed area.	SF	5	8
*** {Severity H}			
* **Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	5	8
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	5	8
*** {Severity H}			
* **Erosion, displacement of material from behind bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.07** **BULKHEADS - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.08 BULKHEADS - CONCRETE

A concrete bulkhead is constructed of interlocking members of concrete driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 6, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	6	9
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	6	9
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.08 BULKHEADS - CONCRETE

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	6	10
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	6	10
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	6	10
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.08 **BULKHEADS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Erosion, displacement of material from behind bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.09 BULKHEADS - METAL

A metal bulkhead is constructed of interlocking members of steel driven into the ground. The bulkhead forms a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal dead and live loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 7, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Structurally damaged by impact or other means.**			
Observation:			
a. Loose or bent sections that do not result in an open seam or hole.	SF		
*** {Severity L}			
b. Open seams, holes or missing section in sheet piling.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF	7	
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.09** **BULKHEADS - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Erosion, displacement of material from behind openings in bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.10 BULKHEADS - STONE MASONRY (CYCLOPEAN WALLS)

A cyclopean bulkhead wall is a heavy structure constructed of stone masonry supported by wood, steel or concrete piles driven individually. The bulkhead wall is built to form a vertical wall for retaining earth or fill, excluding water, and supporting heavy vertical and horizontal designed loads. Both above-water and underwater portions of the bulkhead shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 8, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective mortar.**			
Observation:			
a. Cracked joint material.	SF		
*** {Severity L}			
b. Loose/missing joint material.	SF		
*** {Severity H}			
*** Displacement of stones in wall surface.**			
Observation:			
a. Cracked or damaged stones.	SF		
*** {Severity M}			
b. Loose or missing stones.	SF		
*** {Severity H}			
*** Erosion, displacement of material from behind openings in bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of wall not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of wall exposed.	SF		
*** {Severity H}			
*** Misalignment of wall.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.06 QUAYWALLS

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL

A tie rod is a steel rod used as a connector or brace. Steel tie rods and long bolts are used in conjunction with wood and steel bracing, wales, chocks, anchors and related fittings to structurally support and anchor wood, concrete or steel bulkhead members. Both the above-water and underwater portions of the tie rods and long bolts shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 9, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose.**			
Observation:			
a. Failure/missing wrappings on tie rods.	EA		
*** {Severity M}			
b. Lack of tautness.	EA		
*** {Severity M}			
c. Bent tie rods.	EA		
*** {Severity H}			
d. Missing or broken connections.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
*** Overloads.**			
Observation:			
a. Tension - elongated, necking down.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.11 PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.12 PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD

Wood members are used for bracing other members to form a stable structure. Wales are long, horizontal braces. A chock is a wedge or block, commonly wooden, fitted between piling or other structures to steady them. Bracing, wales and chocks are used in conjunction with tie rods, long bolts and related fittings to structurally support and anchor bulkhead members. Both above-water and underwater portions of the bracing, wales and chocks shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 10, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken, or split member.	SF		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage.**			
Observation:			
a. Insect infestation or decay of wood, indicated by any loss of material thickness.	EA	10	
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL

Steel members are used for bracing other members to form a stable structure. Wales are long, horizontal braces. A chock is a wedge or block, fitted between piling or other structural members to steady them. Bracing, wales and chocks are used in conjunction with tie rods, long bolts and related fittings to structurally support and anchor bulkhead members. Both above-water and underwater portions of the bracing, wales and chocks shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 11, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.13 PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.14 DECK SURFACES - WOOD

Wood deck surfaces are installed to provide a surface to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	12	11
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	12	11
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	12	11
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.14 DECK SURFACES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.15 DECK SURFACES - CONCRETE

Concrete deck surfaces are installed to provide a to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		12
*** {Severity H}			
d. Disintegration of surface or cracks exceeding depth of 2".	SF		12
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		13
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.15 DECK SURFACES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		13
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		13
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
* **Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.16 DECK SURFACES - METAL

Metal deck surfaces are installed to provide a to accommodate operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		14
*** {Severity H}			
* **Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
* **Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
b. Damaged or missing grating.	SF		
*** {Severity L}			
* **Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		14
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.16 DECK SURFACES - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
*** Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.17 HANDRAILS/GUARDRAILS - WOOD

A wood handrail or guardrail on the quaywall deck is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	13	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	LF	13	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	13	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.18 HANDRAILS/GUARDRAILS - CONCRETE

A concrete handrail or guardrail on the quaywall deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged concrete handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in dia.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.18 HANDRAILS/GUARDRAILS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.19 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail on the quaywall deck is a safety barrier or a narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.20 CATWALKS - WOOD

A wooden catwalk, ramp or brow, provides egress to an otherwise inaccessible area. They normally consists of a wood frame with wood sheathing or plank decking and related supports. The surface will normally have a treatment or covering.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken of deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	14	15
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	14	15
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	14	15
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Loose, damaged, or missing covering.	SF		
*** {Severity L}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.20 CATWALKS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.21 CATWALKS - METAL

A metal catwalk, ramp or brow, provides egress to an otherwise inaccessible area. They normally consists of a metal frame with a metal plate or grate decking, usually with a rubberized runner or safety tread and related supports. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		16
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/runner.	SF		
*** {Severity L}			
b. Damaged or missing grating.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		16
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

♦ 21.06.21 CATWALKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.22 LADDERS - WOOD

Ladders are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. Wooden ladders are typically constructed with side rails of 2" nominal thickness and rungs of 1 5/32" diameter. The wooden rungs may be reinforced with steel rods.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection site.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection site.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Split, cracked or broken members.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged, broken or deflected.	LF		
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	15	
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.22 LADDERS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	15	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, crushing.	LF	15	
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

♦ 21.06.23 LADDERS - METAL

Ladders are strategically located to provide safe egress for climbing up and down to an otherwise inaccessible area. A metal ladder typically is 18" wide with 3/4" diameter rungs spaced 12" on center and wall brackets maintaining a 7" clearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	16	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformed, twisted, or bent.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF	16	
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.24 DECK CURBING - WOOD

Wood curbing on the quaywall deck is strategically located to facilitate safe traffic egress for waterfront operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or loose curbing.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing curbing section.	LF		
*** {Severity H}			
*** Split, cracked or broken.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	LF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	LF		
*** {Severity H}			
c. Physically damaged or broken.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF		
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	LF		
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.24 DECK CURBING - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.25 DECK CURBING - CONCRETE

Concrete curbing on the quaywall deck is strategically located to facilitate safe egress for waterfront operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose curbing section.**			
Observation:			
a. Physically loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.25 DECK CURBING - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.26 DECK CURBING - METAL

Metal curbing on the quaywall deck is strategically located to facilitate safe traffic egress for waterfront operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loose, broken or missing curbing section.**			
Observation:			
a. Loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.27 DECK SCUPPERS AND DRAINAGE SLOTS - CONCRETE

Concrete scuppers and drains on the quaywall deck are openings strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage of water and drains are channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers or drainage slots.**			
Observation:			
a. Clogged openings.	EA		
*** {Severity L}			
b. Broken trough.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.28 DECK DRAINS, SCUPPERS AND DRAINAGE SLOTS - METAL

Deck scuppers and drains on the quaywall deck are strategically located to drain surface water runoff into the sea. Scuppers are openings for drainage or water and drains are channels which carry water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers, drains or curb slots.**			
Observation:			
a. Clogged drain.	EA		
*** {Severity L}			
b. Missing, broken or loose bolts.	EA		
*** {Severity L}			
c. Broken drains, drain covers or scuppers.	EA		
*** {Severity H}			
*** Corroded scuppers or drains.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.29 MANHOLE COVERS - METAL

Metal manhole covers are strategically located to facilitate safe access and operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective manhole covers.**			
Observation:			
a. Loose hinge pins.	EA		
*** {Severity L}			
b. Bent, worn, or missing hinge pins.	EA		
*** {Severity M}			
c. Broken or missing covers.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.30 MARINE HARDWARE - METAL

Metal marine hardware fittings consist of bollards, bitts, cleats, chocks and capstans all strategically located along the quaywall deck and securely anchored to the structure to facilitate handling lines for vessel mooring and operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective marine hardware.**			
Observation:			
a. Rough or sharp line contact surfaces.	EA		
*** {Severity L}			
b. Loose, missing or defective bolts.	EA		
*** {Severity M}			
c. Worn, broken or missing.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.31 FIREWALL PARTITIONS - WOOD

Wooden firewall partitions are of airtight construction installed on the underside of the open type construction section of a quaywall. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, more than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	17	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and sawdust observed.	SF	17	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	17	
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.31 FIREWALL PARTITIONS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.32 FIREWALL PARTITIONS - CONCRETE

Concrete firewall partitions are of airtight construction installed on the underside of the open type construction section of a quaywall. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		17
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		17
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		18
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.32 FIREWALL PARTITIONS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		18
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		18
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.33 FIREWALL PARTITIONS - METAL

Metal firewall partitions are of airtight construction installed on the underside of the open type construction section of a quaywall. They are located at strategic intervals along its length to act as a baffle in order to restrict the movement of air and fire.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		19
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		19
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.34 STRUCTURAL FRAME MEMBERS - WOOD

Wood structural frame members interconnect with other members to form a stable structure. They include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Split, cracked, broken, or missing.**			
Observation:			
a. Surface fibers separated, less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Surface fibers separated, greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Physically missing, damaged, broken or deflected.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	18	20
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	18	20
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	18	20
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.35 STRUCTURAL FRAME MEMBERS - CONCRETE

Concrete structural frame members interconnect with other members to form a stable structure. They include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose members.**			
Observation:			
a. Physically loose member.	EA		
*** {Severity M}			
b. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		21
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		21
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		22
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.35 STRUCTURAL FRAME MEMBERS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		22
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		22
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.36 STRUCTURAL FRAME MEMBERS - METAL

Steel structural frame members interconnect with other members to form a stable structure. They include columns, beams, girders and braces.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		23
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		23
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.36 STRUCTURAL FRAME MEMBERS - METAL (Continued)

Defect:	**UOM**	**LEVEL II KEY**	**LEVEL III KEY**
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.37 ROCK DIKES**

Rock dikes are an artificial embankments or ridges consisting of stones, boulders or concrete armor units of various sizes placed on the bottom or on the firm bottom embankment. All voids are completely filled and compacted, to act as protection against erosion and to retain the embankment or fill material. Both above-water and underwater portions of the rock dike shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in dike.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Loss of section.	SF		
*** {Severity H}			
e. Undermining of foundation.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ **21.06.38 RIPRAP**

Riprap consists of stones, boulders or concrete armor units of miscellaneous sizes placed without order on the surface of an earthen structure or embankment to act as protection against erosion from wave motion. Both above-water and underwater portions of the riprap shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Loss of section.	SF		
*** {Severity H}			
e. Undermining of foundation.	SF		
*** {Severity H}			

21.06 QUAYWALLS

COMPONENTS (Continued)

◆ 21.06.39 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the quaywall structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material (area of quaywall structure effected).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep. *** {Severity L}	SF		
b. Erosion of material, less than or equal to 2′ deep. *** {Severity L}	SF		
c. Buildup of material, greater than 2′ deep. *** {Severity H}	SF		
d. Erosion of material, greater than 2′ deep. *** {Severity H}	SF		

21.06 QUAYWALLS

REFERENCES

1. NAVFAC DM-2, Series Structural Engineering
2. NAVFAC DM-2.02, Structural Engineering General Requirements
3. NAVFAC DM-2.02, Structural Engineering Loads
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. NAVFAC MO-312, Wood Protection, 1990
6. Means Concrete Repair and Maintenance, Peter Emmons, 1984
7. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
8. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
9. NAVFAC DM-25, Waterfront Operational Facilities
10. NAVDOCKS P-272, Part I, Vol. I, Definitive Designs for Shore Facilities
11. U.S. Department of Transportation, Bridge Inspector's Training Manual/1990
12. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
13. U.S. Army TM5-624, Maintenance and Repair of Surface Areas

21.06 QUAYWALLS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.06.01-1
2	GS-II 21.06.02-2
3	GS-II 21.06.03-3
4	GS-II 21.06.04-4
5	GS-II 21.06.07-5
6	GS-II 21.06.08-6
7	GS-II 21.06.09-7
8	GS-II 21.06.10-8
9	GS-II 21.06.11-9
10	GS-II 21.06.12-10
11	GS-II 21.06.13-11
12	GS-II 21.06.14-12
13	GS-II 21.06.17-13
14	GS-II 21.06.20-14
15	GS-II 21.06.22-15
16	GS-II 21.06.23-16
17	GS-II 21.06.31-17
18	GS-II 21.06.34-18

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.06.01-1
2	GS-III 21.06.02-2
3	GS-III 21.06.02-3
4	GS-III 21.06.03-4
5	GS-III 21.06.05-5
6	GS-III 21.06.05-6
7	GS-III 21.06.06-7
8	GS-III 21.06.07-8
9	GS-III 21.06.08-9
10	GS-III 21.06.08-10
11	GS-III 21.06.14-11
12	GS-III 21.06.15-12
13	GS-III 21.06.15-13
14	GS-III 21.06.16-14
15	GS-III 21.06.20-15
16	GS-III 21.06.21-16
17	GS-III 21.06.32-17
18	GS-III 21.06.32-18
19	GS-III 21.06.33-19
20	GS-III 21.06.34-20
21	GS-III 21.06.35-21

21.06 QUAYWALLS

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
22	GS-III 21.06.35-22
23	GS-III 21.06.36-23
24*	GS-III 21.06.39-24*

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-II 21.06.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-II 21.06.02-2

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-II 21.06.03-3

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of steel piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: PILE CAPS - WOOD
CONTROL NUMBER: GS-II 21.06.04-4

Application

This guide applies to the investigation of deterioration of wood pile caps due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-II 21.06.07-5

Application

This guide applies to the investigation of possible deterioration of wood bulkhead members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1993

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-II 21.06.08-6

Application

This guide applies to the investigation of possible deterioration of concrete bulkhead members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: BULKHEADS - METAL
CONTROL NUMBER: GS-II 21.06.09-7

Application

This guide applies to the investigation of possible deterioration of steel sheet piling.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine surface area affected by deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: BULKHEADS - STONE MASONRY
CONTROL NUMBER: GS-II 21.06.10-8

Application

This guide applies to the investigation of possible deterioration of stone masonry bulkheads.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: PILING/BULKHEAD TIE RODS, LONG BOLTS - METAL
CONTROL NUMBER: GS-II 21.06.11-9

Application

This guide applies to the investigation of possible damage or deterioration of metal tie rods and long bolts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 10

COMPONENT: PILING/BULKHEAD BRACING, WALES, CHOCKS - WOOD
CONTROL NUMBER: GS-II 21.06.12-10

Application

This guide applies to the investigation of possible deterioration of wood bracing, wales and chocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bracing, wale or chock exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 11

COMPONENT: PILING/BULKHEAD BRACING, WALES, CHOCKS - METAL
CONTROL NUMBER: GS-II 21.06.13-11

Application

This guide applies to the investigation of possible damage or deterioration of metal bracing, wales and chocks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 12

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-II 21.06.14-12

Application

This guide applies to the investigation of deterioration of wood planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 13

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 21.06.17-13

Application

This guide applies to the investigation of deterioration of wood handrail/guardrail members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 14

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-II 21.06.20-14

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 15

COMPONENT: LADDERS - WOOD
CONTROL NUMBER: GS-II 21.06.22-15

Application

This guide applies to the investigation of deterioration of wood ladders due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 16

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 21.06.23-16

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Rampsey/Sleeper, 1981

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 17

COMPONENT: FIREWALL PARTITIONS - WOOD
CONTROL NUMBER: GS-II 21.06.31-17

Application

This guide applies to the investigation of deterioration of wood firewall partition members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 18

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-II 21.06.34-18

Application

This guide applies to the investigation of deterioration of structural wood members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.06.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.06.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.06.02-2

Application

This guide applies to the investigation of cracks in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.06.02-2

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.06.02-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.06.02-3

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.06.03-4

Application

This guide applies to the investigation of cracks and cracked welds in steel piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from suspected area using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Inspect extent of deformation for cracks.
3. Perform ultrasonic pulse velocity test to determine degree of cracking.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: PILES - METAL
CONTROL NUMBER: GS-III 21.06.03-4

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.06.05-5

Application

This guide applies to the investigation of cracks in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: PILE CAPS - CONCRETE
CONTROL NUMBER: GS-III 21.06.05-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: PILE CAPS - METAL
CONTROL NUMBER: GS-III 21.06.06-7

Application

This guide applies to the investigation of cracks and cracked welds in steel pile caps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-III 21.06.07-8

Application

This guide applies to the investigation of possible deterioration of wood bulkheads due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing for lab analysis to determine the size, locations and areas of deterioration of the bulkhead. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: BULKHEADS - WOOD
CONTROL NUMBER: GS-III 21.06.07-8

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.06.08-9

Application

This guide applies to the investigation of cracks in concrete bulkhead walls.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
3. Take core samples of selected deteriorated areas in order to determine the cause and depth of deterioration, the chemical content, particularly chlorides, within the concrete, and the actual compressive strength. Following coring, the holes should be patched using an approved epoxy grout.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.06.08-9

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Schmidt test hammer
6. Increment borer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.06.08-10

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete bulkheads.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: BULKHEADS - CONCRETE
CONTROL NUMBER: GS-III 21.06.08-10

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: DECK SURFACES - WOOD
CONTROL NUMBER: GS-III 21.06.14-11

Application

This guide applies to the investigation of deterioration of wood deck planking due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.06.15-12

Application

This guide applies to the investigation of cracks in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
2. Check general appearance for any conditions that may cause cracking or surface deterioration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and height.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Schmidt test hammer
2. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12 (Continued)

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.06.15-12

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC DM-25, Waterfront Operational Facilities
5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90
6. MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: DECK SURFACES - CONCRETE
CONTROL NUMBER: GS-III 21.06.15-13

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: DECK SURFACES - METAL
CONTROL NUMBER: GS-III 21.06.16-14

Application

This guide applies to the investigation of cracks and cracked welds in metal deck surfaces.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: CATWALKS - WOOD
CONTROL NUMBER: GS-III 21.06.20-15

Application

This guide applies to the investigation of deterioration of wood catwalk members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: CATWALKS - METAL
CONTROL NUMBER: GS-III 21.06.21-16

Application

This guide applies to the investigation of cracks and cracked welds in metal catwalk members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.06.32-17

Application

This guide applies to the investigation of cracks in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: FIREWALL PARTITIONS - CONCRETE
CONTROL NUMBER: GS-III 21.06.32-18

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: FIREWALL PARTITIONS - METAL
CONTROL NUMBER: GS-III 21.06.33-19

Application

This guide applies to the investigation of cracks and cracked welds in metal firewall partitions.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: STRUCTURAL FRAME MEMBERS - WOOD
CONTROL NUMBER: GS-III 21.06.34-20

Application

This guide applies to the investigation of deterioration of wood structural frame members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.06.35-21

Application

This guide applies to the investigation of cracks in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22

COMPONENT: STRUCTURAL FRAME MEMBERS - CONCRETE
CONTROL NUMBER: GS-III 21.06.35-22

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23

COMPONENT: STRUCTURAL FRAME MEMBERS - METAL
CONTROL NUMBER: GS-III 21.06.36-23

Application

This guide applies to the investigation of cracks and cracked welds in metal structural frame members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.06.39-24*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:

    a. Operation must be conducted experienced personnel.
    b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
    c. Proper protective clothing and equipment must be used.
    d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
    e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
    f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24* (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.06.39-24*

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.07 JETTIES

DESCRIPTION

Jetties is a subsystem of the Waterfront System. A jetty is a structure, such as a rubble mound or wall, located at or near the entrance of a harbor or river. Jetties are used to direct and confine the flow of water due to currents and tides to prevent the formation of sandbars.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Jetties:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Scales
6. Hammer (for sounding)

For components requiring underwater inspections, diving gear and communicating equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Jetties, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

21.07.01	PILES - SHEET STEEL
21.07.02	WALES - METAL
21.07.03	TIE RODS, LONG BOLTS - METAL
21.07.04	RUBBLE-MOUND STRUCTURES
21.07.05	HARBOR BOTTOM

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.03	PIERS
21.09	GROINS
21.10	SEAWALLS
21.12	BREAKWATERS

21.07 JETTIES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.07.01 PILES - SHEET STEEL

Steel sheet piling consists of flattened Z-shaped interlocking piles driven into the ground the sheet piling forms a vertical bulkhead wall for retaining dredged or other type fill material, excluding water and to resist heavy lateral forces. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Structurally damaged by impact or other means.**			
Observation:			
a. Loose or bent sections that do not result in an open seam or hole.	SF		
*** {Severity L}			
b. Open seams, holes or missing section in sheet piling.	SF		
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Movement of sheet piling, greater than 1 foot displacement.	EA		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.01 PILES - SHEET STEEL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF	1	
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			
*** Displacement of cellular material.**			
Observation:			
a. Settlement or loss of cellular material.	SF		
*** {Severity M}			
b. Missing section of cover stone or bedding layer.	SF		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.02 WALES - METAL

Metal wales are long, horizontal braces that are used in conjunction with tie rods, long bolts and related fittings to structurally support and anchor sheet steel jetty members. Both the above-water and underwater portions of the wales shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.02 WALES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.03 TIE RODS, LONG BOLTS - METAL

A tie rod is a steel rod used as a connector or brace. Steel tie rods and long bolts are used in conjunction with wales anchors and related fittings to structurally support and anchor sheet steel jetty members. Both the above-water and underwater portions of the tie rods and long bolts shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or loose.**			
Observations:			
a. Failure/missing wrappings on tie rods.	EA		
*** {Severity M}			
b. Lack of tautness.	EA		
*** {Severity M}			
c. Bent tie rods.	EA		
*** {Severity H}			
d. Missing or broken connections.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion, no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
*** Overloads.**			
Observation:			
a. Tension - elongated, necking down.	EA		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ **21.07.03 TIE RODS, LONG BOLTS - METAL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	EA		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.04 RUBBLE-MOUND STRUCTURES

A rubble-mound structure is an artificial embankment or ridge type jetty constructed on the ocean floor consisting of stones, boulders, or concrete armor units of various sizes to act as protection against erosion and scour by water flow, wave or other movement. Both above-water and underwater portions of the structure shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Undermining of foundation.	SF		
*** {Severity H}			
e. Washing out of substrate at the toe of structure.	SF		
*** {Severity H}			
f. Dislodgement of capstones by wave action.	SF		
*** {Severity H}			
g. Loss of section.	SF		
*** {Severity H}			

21.07 JETTIES

COMPONENTS (Continued)

◆ 21.07.05 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the jetty structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material (area of jetty structure effected).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, greater than 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, greater than 2′ deep.	SF		
*** {Severity H}			

21.07 JETTIES

REFERENCES

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-322, Volume I and Volume II, Inspection Of Shore Facilities, 1993
3. NAVFAC DM-25, Waterfront Operational Facilities
4. NAVDOCKS P-272, Part I, Volume I, Definitive Designs For Shore Facilities
5. U.S. Department Of Transportation, Bridge Inspector's Training Manual/1990
6. TM 5-622/MO-104/AFM 91-34, Maintenance of Waterfront Facilities, 1987

21.07 JETTIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.07.01-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1*	GS-III 21.07.05-1*

* Indicated guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - SHEET STEEL
CONTROL NUMBER: GS-II 21.07.01-1

Application

This guide applies to the investigation of possible deterioration of steel sheet piling.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine surface area affected by deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.07.05-1*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:
   a. Operation must be conducted experienced personnel.
   b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
   c. Proper protective clothing and equipment must be used.
   d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
   e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
   f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1* (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.07.05-1*

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.08 BREAKWATERS

DESCRIPTION

Breakwaters is a subsystem of the Waterfront System. Breakwaters are large rubble-mound structures, located at the outer limits of a harbor, anchorage, or coastline, to protect the inner waters and shorelines against the effect of heavy seas and winds and help to ensure safe mooring, operating, loading, or unloading of ships within the harbor.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Breakwaters, beyond the requirements listed in the Standard Tools Section. For component requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this book.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Breakwaters, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspections must be accomplished by a certified diver, as indicated in the introduction of this book.

COMPONENTS LIST

- ◆ 21.08.01 RUBBLE-MOUND STRUCTURES
- ◆ 21.08.02 HARBOR BOTTOMS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.07 JETTIES
21.09 GROINS
21.10 SEAWALLS

21.08 BREAKWATERS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.08.01 RUBBLE-MOUND STRUCTURES

An artificial embankment or ridge constructed on the ocean floor consisting of stones, boulders, or concrete armor units of various size to act as protection against erosion from wave motion. Both above-water and underwater portions of the structure shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Displacement of material.**			
Observation:			
a. Erosion of small stones in riprap.	SF		
*** {Severity L}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity M}			
c. Erosion of core material.	SF		
*** {Severity M}			
d. Undermining of foundation.	SF		
*** {Severity H}			
e. Washing out of substrate at the toe of structure.	SF		
*** {Severity H}			
f. Dislodgement of stones.	SF		
*** {Severity H}			
g. Missing section.	SF		
*** {Severity H}			

21.08 BREAKWATERS

COMPONENTS (Continued)

◆ 21.08.02 HARBOR BOTTOMS

The harbor bottom, as referenced here, is the earth material under the body of water immediately adjacent to the wharf structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Displacement of material (estimated volume).**			
Observation:			
a. Buildup of material, ≤ 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, ≤ 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, > 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, > 2′ deep.	SF		
*** {Severity H}			

21.08 BREAKWATERS

REFERENCES

1. TM 5-622/MO-104/AFM 91-34, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

3. NAVFAC MO-322, Volume I and Volume II, Inspection Of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. NAVDOCKS P-272, Part I, Volume I, Definitive Designs For Shore Facilities

6. U.S. Department Of Transportation, Bridge Inspector's Training Manual/1990

21.08 BREAKWATERS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
N/A	

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1*	GS-III 21.08.02-1*

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.08.02-1*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:
   a. Operation must be conducted by experienced personnel.
   b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
   c. Proper protective clothing and equipment must be used.
   d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
   e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
   f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1* (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.08.02-1*

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.09 GROINS

DESCRIPTION

Groins is a subsystem of the Waterfront System. A groin consists of a narrow structure projecting out perpendicular to the shoreline. These structures are constructed of large rocks or pre-cast concrete units (semipermeable type groin); of concrete or wood piles; or steel or timber sheet piling. They are designed to influence offshore currents and wave action in a manner that will minimize erosion of the shoreline.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Groins:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife

For components requiring underwater inspections, diving gear and communicating equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Groins, beyond the requirements listed in the General and Waterfront Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

21.09 GROINS

COMPONENT LIST

- 21.09.01 PILES - WOOD
- 21.09.02 PILES - CONCRETE
- 21.09.03 PILES - SHEET STEEL
- 21.09.04 PILES - WOOD SHEET AND WALES
- 21.09.05 SEMIPERMEABLE TYPE GROINS
- 21.09.06 HARBOR BOTTOM

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.03 PIERS
21.06 QUAYWALLS
21.07 JETTIES
21.08 BREAKWATERS
21.10 SEAWALLS

21.09 GROINS

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.09.01 PILES - WOOD

A wood pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. For observations involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.01 PILES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.02 PILES - CONCRETE

A concrete pile is a long slender structural member which is driven, jetted or otherwise embedded into the ground beneath the water to support vertical loads or to resist lateral forces. Both above-water and underwater portions of the pile shall be inspected. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles.**			
Observation:			
a. Missing, broken or fractured piles.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	2	2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	2	2
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	2	3
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	2	3
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	2	3
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.02 PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.03 PILES - SHEET STEEL

Steel sheet piling consists of flattened Z-shaped interlocking piles driven into the ground the sheet piling forms a vertical bulkhead wall for retaining dredged or other fill type material, excluding water and to resist heavy lateral forces. Both above-water and underwater portions of the pile shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Structurally damaged by impact or other means.**			
Observation:			
a. Loose or bent sections that do not result in an open seam or hole.	SF		
*** {Severity L}			
b. Open seams, holes or missing section in sheet piling.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Movement of bulkhead, greater than 1 foot displacement.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF	3	
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ **21.09.03 PILES - SHEET STEEL (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			
*** Erosion, displacement of material from behind bulkheads.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.04 PILES - WOOD SHEET AND WALES

Wood sheet piling consists of heavy interlocking wood members driven into the ground, secured by wales, piles, tie-rods, long bolts, anchors and related fittings. The sheet piling forms a vertical bulkhead wall for retaining dredged or other fill material, excluding water and to resist heave lateral forces. Both above-water and underwater portion of the piling shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 4, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loose, missing, broken or split member.**			
Observation:			
a. Loose member.	SF		
*** {Severity L}			
b. Missing, broken, or split member.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	4	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and sawdust observed.	SF	4	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	4	4
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.05 SEMIPERMEABLE TYPE GROINS

Semipermeable groins consist of stones, boulders, or concrete armor units of miscellaneous size placed without order on the surface of an earthen structure to act as protection against erosion and scour by water flow, wave action and other movement. Both above-water and underwater portions of the groin shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Dislodgement of capstones from wave action.	SF		
*** {Severity M}			
b. Loss of side slope material/sloughing.	SF		
*** {Severity H}			
c. Missing section.	SF		
*** {Severity H}			

21.09 GROINS

COMPONENTS (Continued)

◆ 21.09.06 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the groin structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material (area of groin structure effected).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, greater than 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, greater than 2′ deep.	SF		
*** {Severity H}			

21.09 GROINS

REFERENCES

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. TM 5-622/MO-104/AFM 92-34, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. NAVDOCKS P-272, Part I, Vol. I, Definitive Designs for Shore Facilities

6. NAVFAC MO-312, Wood Protection, 1990

21.09 GROINS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.09.01-1
2	GS-II 21.09.02-2
3	GS-II 21.09.03-3
4	GS-II 21.09.04-4

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.09.01-1
2	GS-III 21.09.02-2
3	GS-III 21.09.02-3
4	GS-III 21.09.04-4
5*	GS-III 21.09.06-5*

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-II 21.09.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-II 21.09.02-2

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile. A general range of the extent of cleaning required per facility is 3-15 percent of all piles, which encompasses the combined effects of many influencing factors. Therefore, the number of piles cleaned will be based on experience judgement.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - STEEL SHEET
CONTROL NUMBER: GS-II 21.09.03-3

Application

This guide applies to the investigation of possible deterioration of steel sheet piling.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine surface area affected by deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: PILES - TIMBER SHEET AND WALES
CONTROL NUMBER: GS-II 21.09.04-4

Application

This guide applies to the investigation of possible deterioration of timber sheet piles and wales due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the bulkhead. A general range of these random intervals is 50-300 LF, which encompasses the combined effects of many influencing factors. Therefore, the lineal intervals between cleaning stations will be based on experience judgement.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the bulkhead exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.09.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1* (Continued)

COMPONENT: PILES - WOOD
CONTROL NUMBER: GS-III 21.09.01-1*

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections of other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.09.02-2

Application

This guide applies to the investigation of cracks in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.09.02-2

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections of other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.09.02-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PILES - CONCRETE
CONTROL NUMBER: GS-III 21.09.02-3

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections of other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: PILES - TIMBER SHEET AND WALES
CONTROL NUMBER: GS-III 21.09.04-4

Application

This guide applies to the investigation of possible deterioration of timber sheet piling and wales due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing to determine the size, locations and areas of deterioration of the bulkhead. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: PILES - TIMBER SHEET AND WALES
CONTROL NUMBER: GS-III 21.09.04-4

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections of other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.09.06-5*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:

    a. Operation must be conducted experienced personnel.
    b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
    c. Proper protective clothing and equipment must be used.
    d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
    e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
    f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5** (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.09.06-5**

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a ten year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.10 SEAWALLS

DESCRIPTION

Seawalls is a subsystem of the Waterfront System. Seawalls are structures, built along and parallel to the shoreline, to protect coastal areas against erosion from wave action or flooding during heavy seas. They may be of rubble-mound or reinforced concrete construction supplemented with steel or concrete piles driven into the ground and strengthened by wales and brace-type piles.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Seawall:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of the Seawalls, beyond the requirements listed in the General and Safety Sections. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.10.01 WALLS - CONCRETE
- ◆ 21.10.02 DECKS - CONCRETE
- ◆ 21.10.03 SCUPPERS AND DRAINS
- ◆ 21.10.04 CURBS - CONCRETE
- ◆ 21.10.05 HANDRAILS/GUARDRAILS - METAL
- ◆ 21.10.06 HANDRAILS/GUARDRAILS - WOOD
- ◆ 21.10.07 RUBBLE/RIPRAP
- ◆ 21.10.08 HARBOR BOTTOM

21.10 SEAWALLS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.03	PIERS
21.06	QUAYWALLS
21.07	JETTIES
21.08	BREAKWATERS
21.09	GROINS

21.10 SEAWALLS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.10.01 WALLS - CONCRETE

Concrete seawalls normally have curved, stepped or vertical walls that are cast in place and contain steel reinforcement members the seawall forms a bulkhead designed for retaining earth or fill on the shore side and for protection against erosion and scour by water flow or other movement on the seaside. Both above-water and underwater portions of the wall shall be inspected. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Misalignment.**			
Observation:			
a. Movement of wall, greater than 1 foot displacement.	SF		
*** {Severity H}			
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	1	1
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	1	1
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.01 WALLS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	1	2
*** {Severity H}			
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	1	2
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	1	2
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.01 WALLS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Erosion, displacement of material from behind wall.**			
Observation:			
a. Erosion below existing grade line, base of bulkhead not exposed.	SF		
*** {Severity M}			
b. Erosion below existing grade line, base of bulkhead exposed.	SF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.02 DECKS - CONCRETE

Seawall concrete deck/slabs normally are cast in place and contain steel reinforcement. The concrete deck provides a hard surface to accommodate egress or operational requirements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		3
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		3
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		4
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ **21.10.02 DECKS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		4
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		4
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Erosion, displacement of material under deck surface.**			
Observation:			
a. Displaced or eroded material under deck surface.	SF		
*** {Severity H}			
* **Unevenness between deck sections.**			
Observation:			
a. Variation greater than 1/2".	LF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.03 SCUPPERS AND DRAINS

A scupper is a channel or opening through a wall or curb that is designed to divert and drain surface water runoff.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged scuppers or drains.**			
Observation:			
a. Clogged drain.	EA		
*** {Severity L}			
b. Missing, broken or loose bolts.	EA		
*** {Severity L}			
c. Broken drains, drain covers or scuppers.	EA		
*** {Severity H}			
*** Corroded scuppers and drains.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.04 CURBS - CONCRETE

Concrete curbs divert or control the flow of surface water runoff.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Missing, broken or loose curbing section.**			
Observation:			
a. Loose curbing section.	LF		
*** {Severity M}			
b. Missing or broken curbing section.	LF		
*** {Severity H}			
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	LF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Disintegration of surface or cracks exceeding depth of 2".	LF		
*** {Severity H}			
* **Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	LF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	LF		
*** {Severity H}			
c. Extensive disintegration of surface area, with corrosion of exposed reinforcing steel.	LF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.04 CURBS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	LF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	LF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	LF		
*** {Severity H}			
d. Exposure of reinforcing steel.	LF		
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	LF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	LF		
*** {Severity H}			
*** Unevenness between curbing sections.**			
Observation:			
a. Variation greater than 1".	LF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.05 HANDRAILS/GUARDRAILS - METAL

A metal handrail or guardrail is a safety barrier or narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.06 HANDRAILS/GUARDRAILS - WOOD

A wood handrail or guardrail is a safety barrier narrow rail to be grasped by a person for support.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	2	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	2	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	2	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.07 RUBBLE/RIPRAP

Rubble/riprap consists of stones, boulders, or concrete armor units of miscellaneous sizes placed without order as an artificial embankment on the shore line to act as protection against erosion and scour by water flow, wave or other movement. Both above-water and underwater portions of the structure shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Displacement of material.**			
Observation:			
a. Loss of riprap due to scouring.	SF		
*** {Severity L}			
b. Loss of side slope material due to sloughing.	SF		
*** {Severity M}			
c. Erosion of core material by wave of action.	SF		
*** {Severity M}			
d. Washing out of substrate at the base the seawall.	SF		
*** {Severity H}			
e. Dislodgement of stones by wave action.	SF		
*** {Severity H})			
f. Loss of section.	SF		
*** {Severity H}			
g. Settling of structure.	SF		
*** {Severity H}			

21.10 SEAWALLS

COMPONENTS (Continued)

◆ 21.10.08 HARBOR BOTTOM

The harbor bottom, as referenced here, is the earth material surface under the body of water immediately adjacent to the seawall structures.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Displacement of material (area of seawall effected).**			
Observation:			
a. Buildup of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
b. Erosion of material, less than or equal to 2′ deep.	SF		
*** {Severity L}			
c. Buildup of material, greater than 2′ deep.	SF		
*** {Severity H}			
d. Erosion of material, greater than 2′ deep.	SF		
*** {Severity H}			

21.10 SEAWALLS

REFERENCES

1. TM 5-622/MO-104/AFM 91-34, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
3. NAVFAC MO-322, Volume I and Volume II, Inspection of Shore Facilities, 1993
4. NAVFAC DM-25, Waterfront Operational Facilities
5. NAVDOCKS P-272, Part I, Volume I, Definitive Designs For Shore Facilities
6. U.S. Department of Transportation, Bridge Inspector's Training Manual/1990
7. TM 50624/MO-102/AFR 85-8, Maintenance and Repair of Surface Areas, 1977

21.10 SEAWALLS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.10.01-1
2	GS-II 21.10.06-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.10.01-1
2	GS-III 21.10.01-2
3	GS-III 21.10.02-3
4	GS-III 21.10.02-4
5*	GS-III 21.10.08-5*

* Indicate guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: WALLS - CONCRETE
CONTROL NUMBER: GS-II 21.10.01-1

Application

This guide applies to the investigation of possible deterioration of concrete walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the wall.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the wall exterior with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 21.10.06-2

Application

This guide applies to the investigation of deterioration of wood handrail/guardrail members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.10.01-1

Application

This guide applies to the investigation of cracks in concrete wall surfaces, usually caused by chemicals and wave action.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as one-half square foot sections at two or three elevations for each station located at specified lineal intervals along the bulkhead.
2. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
3. Take core samples of selected deteriorated areas in order to determine the cause and depth of deterioration, the chemical content, particularly chlorides, within the concrete, and the actual compressive strength. Following coring, the holes should be patched using an approved epoxy grout.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.10.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Schmidt test hammer
6. Increment borer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.10.01-2

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete walls.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: WALLS - CONCRETE
CONTROL NUMBER: GS-III 21.10.01-2

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: DECKS - CONCRETE
CONTROL NUMBER: GS-III 21.10.02-3

Application

This guide applies to the investigation of cracks in concrete deck surfaces, usually caused by chemicals and wave action.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Utilize a Schmidt test hammer to check different locations to compare relative surface quality of the concrete.
2. Check general appearance for any conditions that may cause cracking or surface deterioration.
3. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and height.
4. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Schmidt test hammer
2. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: DECKS - CONCRETE
CONTROL NUMBER: GS-III 21.10.02-3

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

4. NAVFAC DM-25, Waterfront Operational Facilities

5. U.S. Department of Transportation, Bridge Inspector's Training Manual/90

6. MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: DECKS - CONCRETE
CONTROL NUMBER: GS-III 21.10.02-4

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete decks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, 1994, Peter H. Emmons

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5*

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.10.08-5*

Application

This guide applies to the implementation of a hydrographic survey to determine the elevations of the bottom of a body of water. Do not duplicate this effort if it is being performed under an existing base PM or recurring maintenance program.

Hydrographic surveys and topographic surveys usually have a single control base-line. Hydrographic survey operations are made by lead-line sounding or by a fathometer depth-recording instrument mounted in a motor boat which is kept on course on established range lines, as the depth sounding or recordings produce a horizontal profile of the bottom. Fathometer systems cover a range from conventional to automated computer systems. Fathometer systems are being used by the Coast and Geodetic Survey and has to a large extent superseded lead-line sounding.

Special Safety Requirements

The following are special safety requirements beyond those listed in the master safety plan and system safety section, are necessary to perform a hydrographic survey.

1. Hydrographic survey operations by nature of operations from waterfront structures or afloat are inherently hazardous to people performing the work. Some of the more pertinent safety concerns are as follows:
   a. Operation must be conducted experienced personnel.
   b. Daily inspection of the condition, proper adjustment and calibration of the equipment and instruments is important.
   c. Proper protective clothing and equipment must be used.
   d. Work areas should be marked and kept clear of unnecessary equipment and personnel.
   e. An on-shore supervisor must be present to watch for hazards and enforce safety practices.
   f. Communications between supervisor and operators must be maintained at all times.

Inspection Actions

The locations of sounding are determined by one of the following methods:

1. Take sounding on a known range line and read one angle from a fixed point on shore.
2. Take sounding from a boat and read two angles simultaneously from two fixed points on shore.
3. Read two angles from a boat to three fixed points on shore, by means of a sextant.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5* (Continued)

COMPONENT: HARBOR BOTTOM - HYDROGRAPHIC SURVEY
CONTROL NUMBER: GS-III 21.10.08-5*

Inspection Actions (Continued)

4. Read a direction and vertical angle simultaneously from an elevated point on shore.
5. Take sounding at known distances along a calibrated cable stretched between a station on shore and a fixed station in the water on an established range line.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Motor boat
2. Hydrographic survey equipment and instruments
3. Hydrographic survey depth sounding equipment and instruments
4. Hydrographic survey recording equipment and instruments

Recommended Inspection Frequency

This inspection should be performed at the direction of the facility manager on a five year cycle or other periodic basis when the desired degree of reliability justifies the procedure.

References

1. NAVFAC DM-5, Civil Engineering

2. Design and Construction of Ports and Marine Structures, Alonzo, McGraw-Hill Co.

3. Means Facilities Maintenance & Repair Cost Data 1994

21.11 WATERFRONT SPECIALTIES

DESCRIPTION

Waterfront Specialties is a subsystem of the Waterfront System. Waterfront specialties are devices which may be incorporated at strategic locations, as part of a waterfront system, to facilitate operational and safety requirements.

Waterfront specialties by nature of exposure to marine operating conditions may be subject to uncontrolled heavy impact force from vessel berthing and are thus subject to high maintenance and replacement.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of the Waterfront Specialties:

1. Scraper
2. Wire brush
3. Chipping hammer
4. Calipers
5. Depth gauge
6. Scales
7. Hammer (for sounding)
8. Ice pick or pocket knife

For components requiring underwater inspections, diving gear and communications equipment are required for the diver, as indicated in the introduction of this manual.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of the Waterfront Specialties, beyond the requirements listed in the Master Safety Plan and System Safety Section. The underwater inspection must be accomplished by a certified diver, as indicated in the introduction of this manual.

COMPONENT LIST

- ◆ 21.11.01 FIXED FENDER PILES - WOOD
- ◆ 21.11.02 FIXED FENDER PILES - CONCRETE
- ◆ 21.11.03 FIXED FENDER PILES - METAL
- ◆ 21.11.04 FIXED FENDER BRACING, WALES AND CHOCKS - WOOD
- ◆ 21.11.05 FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE
- ◆ 21.11.06 FIXED FENDER BRACING, WALES AND CHOCKS - METAL
- ◆ 21.11.07 FIXED FENDER BEARING PANELS - WOOD
- ◆ 21.11.08 FIXED FENDER BEARING PANELS - CONCRETE
- ◆ 21.11.09 FLOATING FENDERS - FOAM FILLED/PNEUMATIC
- ◆ 21.11.10 FIXED HUNG FENDER SYSTEMS - WOOD
- ◆ 21.11.11 FIXED DIRECTLY MOUNTED FENDER UNITS

21.11 WATERFRONT SPECIALTIES

COMPONENT LIST (Continued)

- ◆ 21.11.12 CABLES AND CABLE CONNECTORS - METAL
- ◆ 21.11.13 CHAFING STRIPS - WOOD
- ◆ 21.11.14 CHAFING STRIPS AND BANDS- METAL
- ◆ 21.11.15 CHAFING STRIPS AND WRAPS - RUBBER/PLASTIC
- ◆ 21.11.16 FLOATING SINGLE AND BUILT-UP LOG CAMELS - WOOD
- ◆ 21.11.17 FLOATING CRIB CAMELS AND SEPARATORS - WOOD
- ◆ 21.11.18 FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

21.01 DOLPHINS
21.02 WHARVES
21.03 PIERS
21.06 QUAYWALLS
21.07 JETTIES
21.08 BREAKWATERS
21.09 GROINS
21.10 SEAWALLS

21.11 WATERFRONT SPECIALTIES

STANDARD INSPECTION METHOD

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 21.11.01 FIXED FENDER PILES - WOOD

A fixed fender wood pile system normally consists of long slender structural members which are driven or jetted or otherwise embedded into the ground beneath the water level. The fender system is strategically placed against the edge of a pier, dock, wharf, quaywall, etc. providing a device or framed structure to cushion the impact from berthing or berthed vessels. For observation involving "diameter loss", a comparison should be made between the diameter of an unaffected cross-section versus the remaining diameter of the affected cross-section. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 1, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split piles.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ **21.11.01 FIXED FENDER PILES - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Insect, rot or fungi damage to pile.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	1	1
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	1	1
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	1	1
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.02 FIXED FENDER PILES - CONCRETE

A fixed fender concrete pile system normally consists of long slender concrete pile structural members which are driven or jetted or otherwise embedded into the ground beneath the water. The fender system is strategically placed against the edge of a pier, dock, wharf, quaywall, etc. providing a device or framed structure to cushion the impact from berthing or berthed vessels. Defects involving deterioration of the concrete surface are usually first observed in the splash zone area. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 2, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or fractured piles.**			
Observation:			
a. Missing, broken or fractured piles.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF	2	2
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF	2	2
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.02 FIXED FENDER PILES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF	2	3
*** {Severity H}			
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF	2	3
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF	2	3
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ **21.11.02 FIXED FENDER PILES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.03 FIXED FENDER PILES - METAL

A fixed fender metal pile system normally consists of long slender metal pile structural members which are driven or jetted or otherwise embedded into the ground beneath the water. The fender system is strategically placed against the edge of a pier, dock, wharf, quaywall, etc. providing a device or framed structure to cushion the impact from berthing or berthed vessels. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 3, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing metal members.**			
Observation:			
a. Missing metal members.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Cross section loss less than or equal to 25 percent.	EA		
*** {Severity L}			
b. Cross section loss greater than 25 percent and less than or equal to 50 percent.	EA		
*** {Severity M}			
c. Cross section loss greater than 50 percent.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	3	4
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.03 FIXED FENDER PILES - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	3	4
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts operations access.	EA		
*** {Severity H}			
*** Deteriorated sacrificial anodes.**			
Observation:			
a. Percent thickness loss, 50 to 80 percent.	EA		
*** {Severity M}			
b. Percent thickness loss, greater than 80 percent.	EA		
*** {Severity H}			
c. Loose fasteners or broken welds.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.04 FIXED FENDER BRACING, WALES AND CHOCKS - WOOD

Wood bracing, wales and chocks are structural members used for bracing other members. Wales are long horizontal braces. A chock is a wedge or block, fitted between piling or other structural members to steady them. Bracing, wales and chocks are used in conjunction with long bolts and related fittings to structurally support and anchor fender system members. Above-water and underwater portions of the fender bracing wales and chocks shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken or split member.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect rot or fungus damage.**			
Observation:			
a. Insect infestation or decay of wood, indicated by any loss of material thickness.	EA	4	
*** {Severity H}			
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.05 FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE

Concrete bracing, wales and chocks are structural members used for bracing other members. Wales are long horizontal braces. A chock is a wedge or block, fitted between pilings or other structural members to steady them. Bracing, wales and chocks are used in conjunction with long bolts and related fittings to structurally support and anchor fender system members. Above-water and underwater portions of the fender bracing, wales and chocks shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Missing or broken members.**			
Observation:			
a. Missing or broken member.	EA		
*** {Severity H}			
* **Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		5
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		5
*** {Severity H}			
* **Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		6
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.05 FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		6
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		6
*** {Severity H}			
*** Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
*** Damaged bolts.**			
Observation:			
a. Loose bolts.	EA		
*** {Severity L}			
b. Cracked, broken or missing bolts.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.06 FIXED FENDER BRACING, WALES AND CHOCKS - METAL

Metal bracing, wales and chocks are structural members used for bracing other members. Wales are long horizontal braces. A chock is a wedge or block, fitted between pilings or other structural members to steady them. Bracing, wales and chocks are used in conjunction with long bolts and related fittings to structurally support and anchor fender system members. Above-water and underwater portions of the fender bracing, wales and chocks shall be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.06 FIXED FENDER BRACING, WALES AND CHOCKS - METAL (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering area of protective covering.	SF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.07 FIXED FENDER BEARING PANELS - WOOD

Wood bearing panels are attached to the face of a fixed fender pile system to provide a smooth bearing surface for the movement of a floating fender and distribute vessel hull impact pressure to the fender system. Both above-water and underwater portions shall be inspected. Note: Closely spaced wood fender piles may also be utilized to provide a smooth bearing surface for the movement of a floating fender.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 5, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken or split member.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	5	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	5	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	5	
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.07 FIXED FENDER BEARING PANELS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connectors/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Restricts travel of floating fender.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.08 FIXED FENDER BEARING PANELS - CONCRETE

Concrete bearing panels are attached to the face of a fixed pile system to provide a smooth bearing surface for the movement of a floating fender and distribute vessel hull impact pressure to the fender system. Both above-water and underwater portions shall be inspected. Note: Closely spaced concrete fender piles may also be utilized to provide a smooth bearing surface for the movement of a floating fender.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 6, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or broken members.**			
Observation:			
a. Missing or broken member.	EA		
*** {Severity H}			
*** Cracking.**			
Observation:			
a. Hairline cracks, no loss of surface.	SF		
*** {Severity L}			
b. Medium cracks, less than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, between 1/16" and 1/4" wide.	LF		
*** {Severity H}			
d. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		
*** {Severity H}			
*** Spalling.**			
Observation:			
a. Not more than 1" deep or 6" in diameter.	SF		
*** {Severity L}			
b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of member.	SF		
*** {Severity H}			
c. Disintegration of surface area, with corrosion of exposed reinforcing steel.	SF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.08 FIXED FENDER BEARING PANELS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Scaling.**			
Observation:			
a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Loss of surface exceeding 1" deep.	SF		
*** {Severity H}			
d. Exposure of reinforcing steel.	SF		
*** {Severity H}			
* **Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	LF		
*** {Severity H}			
* **Popouts.**			
Observation:			
a. Conical holes less than 5/8" in diameter.	SF		
*** {Severity M}			
b. Conical holes greater than 5/8" in diameter.	SF		
*** {Severity H}			
* **Damaged bolts.**			
Observation:			
a. Loose bolts.	EA		
*** {Severity L}			
b. Cracked, broken or missing bolts.	EA		
*** {Severity H}			
* **Misalignment.**			
Observation:			
a. Restricts travel of floating fender.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.09 FLOATING FENDERS - FOAM FILLED/PNEUMATIC

A floating fender consist of either a foam filled or pneumatic device. The fender has built-in end fittings for chain attachment. The fender floats freely with the tide on a bearing surface panel. Vessel hull pressure absorbed by the fender is transferred to the bearing panel and distributed to the fixed fender system. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 7, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective floating fender.**			
Observation:			
a. Physically damaged so that it cannot perform function.	EA		
*** {Severity H}			
b. Missing fender.	EA		
*** {Severity H}			
*** Defective connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity M}			
b. Cracked, broken or missing connectors.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.09 FLOATING FENDERS - FOAM FILLED/PNEUMATIC (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corroded members or connectors.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of of base metal.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.10 FIXED HUNG FENDER SYSTEMS - WOOD

A hung wood fender system normally consists of structural wood framing members which are hung from the edge of a deck.The fender system is strategically placed against the edge of a pier, dock, wharf, quaywall, etc. providing a device or framed structure to cushion and distribute the impact from berthing or berthed vessels. For observation involving "cross section loss", a comparison should be made between the dimensions of an unaffected cross-section versus the remaining dimensions of the affected cross-section. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 8, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split wood members.**			
Observation:			
a. Missing, broken or split member.	SF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	8	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	8	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	8	
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ **21.11.10 FIXED HUNG FENDER SYSTEMS - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective steel support members.**			
Observation:			
a. Loose steel members.	EA		
*** {Severity L}			
b. Missing or damaged steel members.	EA		
*** {Severity H}			
*** Defective steel coil springs.**			
Observation:			
a. Loose springs.	EA		
*** {Severity L}			
b. Missing or damaged springs.	EA		
*** {Severity H}			
*** Defective connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity L}			
b. Missing or damaged connectors.	EA		
*** {Severity H}			
c. Cracked or broken welds.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			
*** Defective rubber buffer.**			
Observation:			
a. Missing or damaged rubber buffer.	EA		
*** {Severity H}			
*** Misalignment.**			
Observation:			
a. Fender restricts operations access.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.10 FIXED HUNG FENDER SYSTEMS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corroded steel members, springs or connectors.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.11 FIXED DIRECTLY MOUNTED FENDER UNITS

Fixed directly mounted fender units are manufactured units which normally consists of a rubbing panel, rubber cushion body, flange connection and retaining chains. The unit is direct-mounted against the edge of a pier, dock, quaywall, etc. providing a device to cushion impact from berthing or berthed vessels.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective rubber cushion body.**			
Observation:			
a. Loose rubber cushion.	EA		
*** {Severity M}			
b. Missing or damaged rubber cushion.	EA		
*** {Severity H}			
*** Damaged connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity M}			
b. Cracked, broken or missing connectors.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.12 CABLES AND CABLE CONNECTORS - METAL

Wire rope cables and cable connectors are used to lash together the top section of timber piles to form a pile cluster.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged cables.**			
Observation:			
a. Loose cables.	LF		
*** {Severity L}			
b. Worn cables (frayed surface).	LF		
*** {Severity M}			
c. Broken or missing cables.	LF		
*** {Severity H}			
*** Damaged connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity L}			
b. Cracked, broken or missing connectors.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.13 CHAFING STRIPS - WOOD

Wood chafing strips are fitted to the berthing faces of pilings and necessary to protect the piling against abrasion from contact with vessels, other structures, ropes or chains. The chafing strips are attached using recessed bolts, countersunk bolts and related fasteners. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 9, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split member.**			
Observation:			
a. Missing, broken or split member.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear above water level.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect, rot or fungus damage.**			
Observation:			
a. Insect infestation or decay of wood, indicated by any loss of material thickness.	EA		
*** {Severity H}			
*** Damaged fasteners.**			
Observation:			
a. Loose fasteners.	EA		
*** {Severity L}			
b. Cracked, broken or missing fasteners.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.14 CHAFING STRIPS AND BANDS - METAL

Metal chafing strips are fitted to the berthing faces of pilings and where necessary to protect piling against abrasion from contact with vessels, other structures, ropes or chains. The chafing strips may be attached using countersunk bolts, steel bands and clips and related fasteners. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 10, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective chafing strips.**			
Observation:			
a. Loose chafing strip.	EA		
*** {Severity L}			
b. Missing or damaged chafing strip.	EA		
*** {Severity H}			
* **Damaged bands.**			
Observation:			
a. Loose bands.	EA		
*** {Severity L}			
b. Cracked, broken or missing bands.	EA		
*** {Severity H}			
* **Damaged fasteners.**			
Observation:			
a. Loose bolts.	EA		
*** {Severity L}			
b. Cracked, broken or missing bolts.	EA		
*** {Severity H}			
* **Corrosion of steel chafing strips or bands.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.15 CHAFING STRIPS AND WRAPS - RUBBER/PLASTIC

Rubber and plastic (PVC, PE) chafing strips and wrappings are fitted to piles where necessary protect piling against abrasion from contact with vessels, other structures, ropes or chains also to act as wrapper/jacket protection against marine environment. The chafing strips and wrappings may be attached by using countersunk bolts, alloy pop rivets, nails, steel aluminum, nylon bands and clips and related fasteners. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 11, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Defective chafing strips or wraps.**			
Observation:			
a. Loose chafing strip or wrap.	EA		
*** {Severity L}			
b. Missing or broken chafing strip or wrap.	EA		
*** {Severity H}			
* **Damaged bands.**			
Observation:			
a. Loose bands.	EA		
*** {Severity L}			
b. Cracked, broken or missing bands.	EA		
*** {Severity H}			
* **Damaged fasteners.**			
Observation:			
a. Loose fasteners.	EA		
*** {Severity L}			
b. Cracked, broken or missing fasteners.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.16 FLOATING SINGLE AND BUILT-UP LOG CAMELS - WOOD

Single log and larger built-up log camels chained from the edge of a pier, dock, wharf, quaywall, etc. or associated fender system, float with the tide to provide a protective rubbing impact surface for vessels. Log camels construction may include cables, cable connectors, chains, chainweights and rubber tire rubbing surface wrapping. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 12, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split wood logs.**			
Observation:			
a. Missing, broken, or split pile.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear of wood logs.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA		
*** {Severity H}			
*** Insect, rot or fungi damage to wood logs.**			
Observation:			
a. Diameter loss from 5 percent to 15 percent.	EA	12	
*** {Severity L}			
b. Diameter loss from 15 percent to 45 percent.	EA	12	
*** {Severity M}			
c. Diameter loss more than 45 percent.	EA	12	
*** {Severity H}			
*** Defective tires.**			
Observation:			
a. Missing or torn tires.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.16 FLOATING SINGLE AND BUILT-UP LOG CAMELS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged cables.**			
Observation:			
a. Loose cables.	EA		
*** {Severity M}			
b. Worn cables (frayed surface).	EA		
*** {Severity H}			
c. Broken or missing cables.	EA		
*** {Severity H}			
*** Damaged connectors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity L}			
b. Cracked, broken or missing connectors.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			
*** Misalignment/differential settlement.**			
Observation:			
a. Out of level, functional.	EA		
*** {Severity M}			
b. Out of level, not functional.	EA		
*** {Severity H}			
*** Corroded chains.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.17 FLOATING CRIB CAMELS AND SEPARATORS - WOOD

Wooden floating crib camels and separators consist of large timbers connected together by struts and cross braces to form a large crib unit. Crib construction may include foam filled floatation buoyancy units, between timbers for higher freeboard, wood decking, wood rubbing fenders, hardware, connectors and securing eye bolts. Wooden crib camels and separators float freely between a pier, dock, wharf, quaywall, etc. and vessel and between vessels to provide a protective rubbing impact surface to absorb and distribute vessel hull pressure. Both above-water and below water portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Key No. 13, to determine an underwater condition assessment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing, broken or split members.**			
Observation:			
a. Missing, broken or split member.	EA		
*** {Severity H}			
*** Deep abrasions or excessive wear of wood members.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	13	
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.17 FLOATING CRIB CAMELS AND SEPARATORS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Parasite damage of wood members.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	13	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	13	
*** {Severity H}			
*** Defective wood rubbing fenders.**			
Observation:			
a. Missing, broken or split wood rubbing fender.	EA		
*** {Severity H}			
*** Damaged hardware, connectors or eye bolts.**			
Observation:			
a. Loose.	EA		
*** {Severity H}			
b. Cracked, broken or missing.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			
*** Misalignment/differential settlement.**			
Observation:			
a. Out of level, functional.	EA		
*** {Severity M}			
b. Out of level, not functional.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.17 FLOATING CRIB CAMELS AND SEPARATORS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corroded chains.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.18 FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED

Floating deep and shallow metal framed camels and separators may include a structural steel support frame, steel floating pontoon tanks, foam filled or fiberglass floatation buoyancy units, wood or steel decking, wales, wood rubbing fenders, rubber fenders, hardware, shackles connectors and retaining chains. Deep steel framed camels and separators are normally used for berthing submarines. Large shallow steel framed camels and separators are normally used for berthing aircraft carriers. The deep and shallow steel framed camels and separators float freely between a pier, dock, wharf, quaywall, etc. and a vessel, or between vessels, to provide a protective rubbing impact surface to absorb and distribute vessel hull pressure. Both above-water and underwater portions shall be inspected.

Many of the defects underwater cannot be detected since they may be hidden by surface biofouling, which will require cleaning of the structural element. Therefore, if necessary, a Level II inspection should be conducted as described in the Level II Inspection Method Guide Sheet, Keys No. 14 and 15, to determine an underwater condition assessment.

Special Hull Treatment (SHT) installed on certain submarines requires careful protection to prevent damage. Accordingly, the camels/separators used to fender submarines with SHT should be inspected more frequently and maintained in a condition that will ensure no damage is done to the SHT. The following are recommended inspection frequencies and special attention items.

A Level I inspection shall be performed on the above-water portions of the camel semi-annually, after submarine departure, and after relocation of camel.

A Level II inspection shall be performed on the entire camel annually and when the camel is damaged, with the camel out of the water or by a diver.

A total assessment (to include Level I, Level II and Level III, if needed) shall be every two years, with the camel out of the water.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing steel members.**			
Observation:			
a. Missing steel members.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.18 FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling of steel members.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF	14	7
*** {Severity H}			
*** Defective tanks.**			
Observation:			
a. Physically damaged dented tanks, not leaking.	EA		
*** {Severity L}			
b. Physically damaged loose, cracked, punctured or leaking tanks.	EA	14	7
*** {Severity H}			
c. Missing or broken tanks.	EA		
*** {Severity H}			
*** Damaged hardware, connectors, shackles or eye bolts.**			
Observation:			
a. Loose.	EA		
*** {Severity H}			
b. Cracked, broken or missing.	EA		
*** {Severity H}			
*** Defective chains.**			
Observation:			
a. Missing or broken chains.	LF		
*** {Severity H}			
*** Missing, broken or split wood members.**			
Observation:			
a. Missing, broken or split wood member.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ 21.11.18 FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Deep abrasions or excessive wear of wood members.**			
Observation:			
a. Cross section loss from 5 percent to 15 percent.	EA		
*** {Severity L}			
b. Cross section loss from 15 percent to 45 percent.	EA		
*** {Severity M}			
c. Cross section loss more than 45 percent.	EA		
*** {Severity H}			
*** Rot, fungus or decay of wood members.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Discolored, soft or crushed area.	SF	15	
*** {Severity H}			
*** Parasite damage of wood members.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag and frass observed.	SF	15	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	15	
*** {Severity H}			
*** Defective rubber fenders.**			
Observation:			
a. Loose rubber fender.	EA		
*** {Severity M}			
b. Missing or broken rubber fender.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

COMPONENTS (Continued)

◆ **21.11.18** **FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Misalignment/differential settlement.**			
Observation:			
a. Out of level, functional.	EA		
*** {Severity M}			
b. Out of level, not functional.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			
*** Deteriorated protective covering.**			
Observation:			
a. Peeling or blistering areas of protective covering.	EA		
*** {Severity H}			

21.11 WATERFRONT SPECIALTIES

REFERENCES

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
2. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
3. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC DM-25, Waterfront Operational Facilities
5. NAVDOCKS P-272, Part I, Vol. I, Definitive Designs for Shore Facilities
6. U.S. Department of Transportation, Bridge Inspector's Training Manual/1990
7. NAVFAC P-422, Economic Analysis Handbook
8. NCEL TM-43-85-01 O&M, UCT, Conventional Inspection and Repair Techniques Manual
9. NAVFACENGCOM MIL-HDBK-1025/1, Piers and Wharves, 1977

21.11 WATERFRONT SPECIALTIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 21.11.01-1
2	GS-II 21.11.02-2
3	GS-II 21.11.03-3
4	GS-II 21.11.04-4
5	GS-II 21.11.07-5
6	GS-II 21.11.08-6
7	GS-II 21.11.09-7
8	GS-II 21.11.10-8
9	GS-II 21.11.13-9
10	GS-II 21.11.14-10
11	GS-II 21.11.15-11
12	GS-II 21.11.16-12
13	GS-II 21.11.17-13
14	GS-II 21.11.18-14
15	GS-II 21.11.18-15

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 21.11.01-1
2	GS-III 21.11.02-2
3	GS-III 21.11.02-3
4	GS-III 21.11.03-4
5	GS-III 21.11.05-5
6	GS-III 21.11.05-6
7	GS-III 21.11.18-7

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FIXED FENDER PILES - WOOD
CONTROL NUMBER: GS-II 21.11.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: FIXED FENDER PILES - CONCRETE
CONTROL NUMBER: GS-II 21.11.02-2

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of concrete piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the pile exterior with a pick or pocket knife to determine the percentage loss due to deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: FIXED FENDER PILES - METAL
CONTROL NUMBER: GS-II 21.11.03-3

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of steel piles.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas. This is usually done at spot locations rather than cleaning the entire pile.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: FIXED FENDER BRACING, WALES, AND CHOCKS - WOOD
CONTROL NUMBER: GS-II 21.11.04-4

Application

This guide applies to the investigation of deterioration of wood bracing, wales, and chocks due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

4. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: FIXED FENDER BEARING PANELS - WOOD
CONTROL NUMBER: GS-II 21.11.07-5

Application

This guide applies to the investigation of possible deterioration of wood bearing panels due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the panel exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: FIXED FENDER BEARING PANELS - CONCRETE
CONTROL NUMBER: GS-II 21.11.08-6

Application

This guide applies to the investigation of possible deterioration of concrete bearing panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer to check for loose layers of concrete or hollow spots. A sharp ring noise indicates sound concrete. A soft surface will be detected not only by sound change, but also by a change in the rebound or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.
4. Carefully chip or probe the suspect areas of the panel with a pick or pocket knife to determine the extent of deterioration.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: FLOATING FENDERS - FOAM FILLED/PNEUMATIC
CONTROL NUMBER: GS-II 21.11.09-7

Application

This guide applies to the investigation of possible deterioration of foam filled/pneumatic floating fenders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Measure the diameter of the fender at its smallest point to record permanent set.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: FIXED HUNG FENDER SYSTEMS - WOOD
CONTROL NUMBER: GS-II 21.11.10-8

Application

This guide applies to the investigation of possible deterioration of wood fender system members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the fender exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: CHAFING STRIPS - WOOD
CONTROL NUMBER: GS-II 21.11.13-9

Application

This guide applies to the investigation of possible damage or deterioration of wood chafing strips.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 10

COMPONENT: CHAFING STRIPS AND BANDS - METAL
CONTROL NUMBER: GS-II 21.11.14-10

Application

This guide applies to the investigation of possible damage or deterioration of metal chafing strips and bands.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 11

COMPONENT: CHAFING STRIPS AND WRAPS - RUBBER/PLASTIC
CONTROL NUMBER: GS-II 21.11.15-11

Application

This guide applies to the investigation of possible damage or deterioration of rubber/plastic chafing strips and wraps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel.

Recommended Inspection Frequency

Perform inspection when triggered by local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 12

COMPONENT: FLOATING SINGLE AND BUILT-UP LOG CAMELS - WOOD
CONTROL NUMBER: GS-II 21.11.16-12

Application

This guide applies to the investigation of possible deterioration of wood camels due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning extend from the mud zone up through the mean-low-water (MLW) areas. The areas to be cleaned are designated as approximately one-half square foot sections at one, two or three elevations for each station located at specified lineal intervals along the camel.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Sound clean areas and minimal growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the camel exterior with a pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

The Level II inspection, which will be performed with the camel out of the water, shall be scheduled at a minimum of every three years.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC MO-104.1, Maintenance of Fender Systems and Camels, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 13

COMPONENT: FLOATING CRIB CAMELS AND SEPARATORS - WOOD
CONTROL NUMBER: GS-II 21.11.17-13

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood crib camels and separators due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the wood exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

The Level II inspection, which will be performed with the camel or separator out of the water, shall be scheduled at a minimum of every three years.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC MO-104.1, Maintenance of Fender Systems and Camels, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 14

COMPONENT: FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED

CONTROL NUMBER: GS-II 21.11.18-14

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Carefully probe the suspect areas of the wood exterior with a pick or pocket knife to determine the percentage loss due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

The Level II inspection, which will be performed with the camel or separator out of the water, shall be scheduled at a minimum of every three years.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC MO-104.1, Maintenance of Fender Systems and Camels, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 15

COMPONENT: FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED

CONTROL NUMBER: GS-II 21.11.18-15

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of metal members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean marine growth from areas to be inspected using scraper, brush, chipping hammer and chisel. Priority locations for cleaning approximately ten inch bands around the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize calipers, depth gauge and scales to determine an approximation of the pile diameter loss.
3. Sound clean areas and minimal marine growth areas with a hammer to detect any scaled steel or hollow areas.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection, other local factors such as problematic conditions, or when biofouling exists such that the condition cannot be assessed without performing a Level II inspection.

The Level II inspection, which will be performed with the camel or separator out of the water, shall be scheduled at a minimum of every three years.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
4. NAVFAC MO-104.1, Maintenance of Fender Systems and Camels, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FIXED FENDER PILES - WOOD
CONTROL NUMBER: GS-III 21.11.01-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of wood piles due to insect infestation, rot or fungi damage.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for hidden or interior damage and the loss of material thickness.
3. Utilize sample coring and in-situ surface hardness testing to determine the size, locations and areas of deterioration of piling. Plug holes with treated wood plugs after boring.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: FIXED FENDER PILES - WOOD
CONTROL NUMBER: GS-III 21.11.01-1

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment
6. Increment borers
7. Treated wood plugs

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

6. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: FIXED FENDER PILES - CONCRETE
CONTROL NUMBER: GS-III 21.11.02-2

Application

This guide applies to the investigation of cracks in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: FIXED FENDER PILES - CONCRETE
CONTROL NUMBER: GS-III 21.11.02-2

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: FIXED FENDER PILES - CONCRETE
CONTROL NUMBER: GS-III 21.11.02-3

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: FIXED FENDER PILES - CONCRETE
CONTROL NUMBER: GS-III 21.11.02-3

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987

2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987

3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993

4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: FIXED FENDER PILES - METAL
CONTROL NUMBER: GS-III 21.11.03-4

Application

This guide applies to the investigation of cracks and cracked welds in steel piles.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: FIXED FENDER PILES - METAL
CONTROL NUMBER: GS-III 21.11.03-4

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE
CONTROL NUMBER: GS-III 21.11.05-5

Application

This guide applies to the investigation of cracks in concrete bracing, wales and chocks.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE
CONTROL NUMBER: GS-III 21.11.05-5

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE
CONTROL NUMBER: GS-III 21.11.05-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete bracing, wales and chocks.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

   a. Daily inspection of the condition of the equipment is important.
   b. Proper protective clothing and equipment must be used.
   c. Work areas should be marked and kept clear of unnecessary personnel.
   d. A supervisor should be present to watch for hazards and enforce safety practices.
   e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean rust/discoloration and/or marine growth from areas to be inspected using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning at least half the perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. For above-water areas, perform half-cell potential test to determine degree of corrosion of steel reinforcement.
3. For underwater areas, utilize ultrasonic pulse velocity test equipment to check for damage extent and loss of integrity.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: FIXED FENDER BRACING, WALES AND CHOCKS - CONCRETE
CONTROL NUMBER: GS-III 21.11.05-6

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Half-cell test equipment
6. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED

CONTROL NUMBER: GS-III 21.11.18-7

Application

This guide applies to the investigation of cracks and cracked welds in metal framed camels and separators.

Special Safety Requirements

The following are special safety requirements beyond those listed in the Master Safety Plan and System Safety Section:

1. Air and water jet operations are inherently hazardous to people performing the work and others in the area. Some of the more pertinent safety concerns are as follows:

    a. Daily inspection of the condition of the equipment is important.
    b. Proper protective clothing and equipment must be used.
    c. Work areas should be marked and kept clear of unnecessary personnel.
    d. A supervisor should be present to watch for hazards and enforce safety practices.
    e. Communication between the blaster and machine operator must be maintained. A deadman control device is required on blasting nozzles that will stop flow when released.

Inspection Actions

1. Clean marine growth from suspected area using hydraulic brushes, scrapers, grinders, high pressure water jets or cavitation erosion jets, if required. Priority locations for cleaning the entire perimeter extend from the mud zone up through the mean-low-water (MLW) areas.
2. Inspect extent of deformation for cracks.
3. Perform ultrasonic pulse velocity test to determine degree of cracking.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Hydraulic rotary brushes
2. Grinders and scrapers
3. High pressure water jets
4. Cavitation erosion jets
5. Ultrasonic pulse velocity test equipment

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: FLOATING DEEP/SHALLOW CAMELS AND SEPARATORS - METAL FRAMED
CONTROL NUMBER: GS-III 21.11.18-7

Recommended Inspection Frequency

Perform inspection when triggered by Level I and II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-104.2, Specialized Underwater Waterfront Facilities Inspections, 1987
2. NAVFAC MO-104, Maintenance of Waterfront Facilities, 1987
3. NAVFAC MO-322, Vol. 1 and Vol. II, Inspection of Shore Facilities, 1993
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
5. Chesapeake Bay Diving Center, Portsmouth, Virginia

APPENDIX A

ABBREVIATIONS

A&E	Architect and Engineering
AIC	American Institute Of Chemists
ASTM	American Society for Testing and Materials
CAIS	Condition Assessment Information System
CAS	Condition Assessment Survey
CERL	Civil Engineering Research Laboratory
CU FT	Cubic Foot
CF	Cubic Foot
DCD	Data Collection Device
DIA	Diameter
FT	Foot
GS	Guide Sheets
HP	Horsepower
HR	Hour
IU	Inspection Unit
LBS	Pounds
LF	Linear Foot
MAX	Maximum
MHW	Mean High Water
MIN	Minimum
MLW	Mean Low Water
N/A	Not Applicable
NAVFAC-	Naval Facilities Maintenance and Operations

APPENDIX A

MO	
NDT	Non-Destructive Testing
OSHA	Occupational Safety And Health Administration
PE	Professional Engineer
PM	Preventive Maintenance
PVC	Polyvinyl Chloride
PSF	Pound per Square Foot
RPIL	Real Property Inventory List
SF	Square Foot
SHT	Special Hull Treatment
T	Ton
TM	Technical Manual
UCT	Underwater Construction Techniques
UOM	Unit Of Measurement
YRS	Years
WBS	Work Breakdown Structure
°	Degrees of Temperature
°C	Degrees Centigrade
°F	Degrees Fahrenheit
=	Equals
'	Feet
>	Greater Than
≥	Greater Than or Equal To
"	Inches

APPENDIX A

$<$	Less Than
$\leq$	Less Than or Equal To
/	Per or Over
%	Percent
+	Plus or Positive or Add
$\pm$	Plus or Minus
$-$	Subtract or Minus or Negative
$\cdot$	Times or By
x	Times or By

APPENDIX B

GLOSSARY

Abrasions	A scraping or rubbing off, as of skin. A wearing away by rubbing or scraping, as of rock by wind and water.
Active	Currently in operation, in effect, in progress. Implies a state of motion, operation, etc..
Aggregates	An inert granular material such as natural sand and gravel which when bound together into a mass by a matrix forms concrete or mortar.
Alignment	An aligning or arrangement in a straight line; a ground plan, as of a field work, railroad etc.
Altar	Stepped walls running parallel to the longitudinal axis of the drydock. Used as working platforms and as stops for shoring braced against the ship and the drydock. Can be one or more depending on the size of the drydock.
Anchor	To keep from drifting, giving way; A heavy object, usually a shaped iron weight with flukes, lowered by chain or cable. Any device that holds another object secure.
Anodes (Sacrificial)	A metal bar or rod (usually zinc) which supplies electrons for cathodic protection of another metal, thereby consuming or "sacrificing" itself.
Arcing	The band of sparks or incandescent light formed when an electric discharge is conducted from one electrode or conducting surface to another, characterized by relatively high current and low potential difference between electrodes.
As-built Drawings	Drawings that show what was actually constructed with all deviations and changes from the original design made during construction.
Baffles	A plate used to control a liquid or gas. An opaque or translucent plate used to shield a light source from direct view at certain angles. A flat deflector or obstruction designed to reduce sound transmission.
Base Metal	The metal to be welded, soldered, or plated.
Batter	To incline from the vertical, a wall is said to batter when it recedes as it rises.

APPENDIX B

Beam	A structural member whose prime function is to carry transverse loads, as a joist, girder, rafter, or purlin.
Bearing Block	A block, either wood or composite which distributes a load on the surface beneath the block.
Bearings	The support for a shaft, axle, or trunnion used to mediate friction; usually in conjunction with a lubricant.
Berthing Face	The intersection of the berthing area (a ship's place of anchorage, or space for tying up) and the edge of the pier, wharf, quaywall, drydock, or other shore facility to which the berth is adjacent.
Biennial	Happening every two years; lasting or living two years.
Bilge	The curve of a ship's hull joining the side to the bottom.
Bilge Blocks	Blocks used to brace the side of the bilge which is the curve of the ship's hull joining the side and the bottom.
Bitts	Any of the deck posts, usually in pairs, around which ropes or cables are wound and held fast.
Blasting Nozzles	A tube-like device, usually streamlined, for accelerating and directing a fluid, whose pressure decreases as it leaves the device. Used to direct flow so that the pressure of the fluid acts to remove any foreign material from the surface the force is directed against.
Blistering	To cause blisters (an enclosed pocket of air mixed with water or solvent vapor); or a raised area on the surface of a metallic or plastic object caused by the pressure of gases developed while the surface was in a partly molten state, or by diffusion of high-pressure gases from an inner surface.
Bollard	Steel cylinders, placed vertically, filled with concrete and secured to foundations by steel bolts, or made part of a monolithic foundation; used to protect a fixture or structure from damage. Also a steel fitting on a pier or wharf around which mooring lines from vessels are tied.
Bootjack	An "A"-frame for lining up the bow of a ship to assist in hauling the ship into longitudinal and transverse position over a marine railway cradle when in outboard position.

APPENDIX B

Buoyancy Chamber	Any enclosed space or compartment which when emptied makes use of the ability or tendency of air to float or rise in liquid providing upward pressure on a floating object.
Bracing	Structural elements installed to provide restraint or support (or both) to other members, so that the complete assembly forms a stable structure; may consist of knee braces, cables, rods, struts, ties, shores, diaphragms, rigid frames.
Breakwaters	A substantial rubble-mound structure located at the outer limits of a harbor or anchorage to protect the inner waters from the effects of heavy seas and to reduce the effect on the shoreline.
Brow	The projecting top edge of a structure or ship. A portable walk or bridge between ship and pier, or landing platform for use of personnel while the ship is berthed. It is usually equipped with handrails and has rollers on the shore end.
Bulkhead	Any of the upright partitions of a ship or drydock, etc. as for protection against fire or leakage. A wall or embankment for holding back earth, fire, water.
Cables	An electrical conductor consisting of a group of small-diameter conductor strands, insulated from each other and twisted together. Any heavy rope or wire line used for support, exerting a force, or for controlling a mechanism.
Caisson	A watertight structure or chamber, within which work is carried on in building foundations or structures below water level. A type of primitive drydock.
Camel	A floating device acting as a fender and used to separate a moored vessel from a pier, wharf, quay, or other vessel; designed to distribute wind and current forces acting on the vessel.
Calipers	An instrument, resembling a pair of dividers, with adjustable legs for measuring the diameter or thickness of bodies.
Capstans	An apparatus around which cables or hawsers are wound for hoisting anchors, lifting weights, etc.: it consists of an upright, spool-shaped cylinder that is turned on an inner shafting by machinery or by hand.
Cast-in-place	Concrete which is deposited in the place where it is required to harden as part of the structure, as opposed to pre-cast concrete.

APPENDIX B

Catwalk	A narrow fixed walkway providing access to an otherwise inaccessible area or to a piece of equipment for service; used above an excavation, drydock, or high building.
Cavitation Erosion Jets	A system using a phenomenon in the flow of water (the formation of cavities in fluid flow due to low pressures attending to high velocities in the fluid) to remove material from a substrate by the pitting action caused by implosion (collapse) of bubbles in flowing water. The water jet is used to direct the flow against the object to be cleaned.
Chafing Strips	A long, narrow piece of wood or other material placed on sides of waterfront structures, fittings, or vessels to protect against abrasion from contact with other structures, ropes, or chains.
Chain	A flexible series of joined links, usually of metal, used to pull, confine, or to transmit power; bonds; shackles.
Channel Gratings	A framework of parallel or latticed bars set in the floor of the drydock covering a trench or tube-like passage for the flow of water to the pumps.
Chocks	A block or wedge, commonly wooden, fitted between pilings or other structures to steady them, prevent motion or to fill in a space. A cast metal block with two hornlike projections curving inward, through which a mooring line may be run.
Cleats	Heavy cast steel fittings with horns, spaced along the edge of the waterfront structure used to secure mooring lines.
Clevises	A "U" shaped piece of iron with holes in the ends through which a pin is run to attach one thing to another; usually ropes or cables.
Cluster	A number of members of the same sort gathered together and physically connected so they act as a single structural element.
Coast Line	Land alongside the sea; seashore; the contour or outline of a coast.
Columns	In structures, a relatively long, slender structural compression member such as a post, pillar, or strut; usually vertical, supporting a load which acts in (or near) the direction of its longitudinal axis.

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Commutator	That part of a direct-current motor or generator which serves the dual function, in combination with brushes, of providing an electrical connection between the rotating armature winding and the stationary terminals, and of permitting reversal of the current in the armature windings.
Composite Keel Blocks	Are built with wood top and bottom layers and concrete sandwiched in between. A sufficient amount of concrete is used to make the blocks nonbuoyant.
Conical	Resembling or shaped like a cone (a solid with a circle for its base and a curved surface tapering evenly to an apex so that any point on this surface is in a straight line between the circumference of the base and its apex.
Coping	A protective cap, top, or cover of wall, parapet, pilaster, or chimney; often of stone, terra-cotta, concrete, metal, or wood. May be flat, but commonly sloping, double beveled, or curved to shed water so as to protect masonry from penetration of water from above. Most effective if extended beyond wall face and cut with a drip.
Corrosion	The deterioration of metal or of concrete by chemical or electrochemical reaction resulting from exposure to weathering, moisture, or chemicals, or other agents in the environment in which it is placed.
Countersunk	The top part of a hole in metal, wood, etc.; has been enlarged so that the head of a bolt, screw, etc. will fit flush with or below the surface.
Coupling	A metal collar with internal threads used to connect two sections of threaded pipe. The mechanical fastening that connects shafts together for power transmission.
Cribbing	A framework, usually of timber, designed to distribute concentrated ship loads and to provide longitudinal stability to the keel blocks.
Cross-section	A section taken at right angles to the longitudinal axis. A drawing or photograph of a plane surface exposed by such a cut.
Culvert	A passage under a road, railway embankment, or canal which allows for the flow of water. Construction may be open or closed; may be of timber, arched masonry, or metal or concrete pipe.

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Curbs	A guard of wood, concrete, or metal located along the outer edge of a wharf or pier to prevent accidental loss of equipment into the water.
Current Draw	The demand of a piece of equipment which determines the flow or rate of flow of electric charge in a conductor or medium between two points having a difference in potential, generally expressed in terms of amperes.
Cyclopean Wall	A wall made of huge stone blocks laid without mortar. A wall of concrete in which large stones, each of 100lbs. or more are placed and embedded as the concrete is deposited.
Cylinder	A solid figure described by the edge of a rectangle rotated around the parallel edge as axis: the ends of the cylinder are parallel and equal circles. Anything having the shape of a cylinder, whether hollow or solid. Specifically, the chamber in which the piston moves in a reciprocating engine; the barrel of a pump; a container used to hold and transport compressed gas for various pressurized applications.
Deadman Control Switch	An electronic device used as a safety mechanism; it is controlled by either a plunger or contact switch which must be held in the on position, any release of pressure on the switch results in a broken connection, turning off the equipment in use.
Dead Load	The weight of a structure itself, including the weight of fixtures or equipment permanently attached to it.
Deadman	A buried concrete block, log, plate, or the like, which serves as an anchorage e.g. as an anchor for a tie to a retaining wall; depends on its own weight and passive pressure from the soil to hold it in place.
Deck	The working surface of a wharf, pier, or vessel.
Defects	An imperfection or weakness; fault; flaw; or blemish. In materials a fault that may reduce the durability, usefulness, or strength.
Deformation	Any change of form, shape, or dimensions produced in a body by a stress or force, without a breach of the continuity of its parts.
Depth Gauge	A device for measuring the depth of a hole, cutout, groove, recess, etc.; usually consists of a graduated scale which slides

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through a crosspiece.

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Deterioration	To make worse; lower in quality or value; depreciate.
Dewatering	Pumping water from a site well to maintain a dry and stable condition during construction. The act of emptying a drydock.
Diameter	A straight line passing through the center of a circle, sphere, etc., from one side to the other. The length of such a line; width or thickness of a circular, or somewhat circular, figure or object.
Dielectric	A nonconductor of electricity; an insulator or insulating material.
Displacement	The weight or volume of a fluid which otherwise would fill the space of a floating object; specifically the weight of water in long tons, displaced by a ship.
Divert	To turn aside from a course or direction; deflect.
Dock	The water area adjacent to a wharf or pier to which a ship can be secured. Often used incorrectly to describe the shore facility adjacent to the mooring area.
Dolphin	A structure consisting of one or a group of piles. It is placed near piers and wharves or in turning basins and ship channels to guide vessels into their moorings; to fend vessels away from structures, shoals, or the shore; to support navigation aids, or to moor a vessel.
Dormant	Inoperative; inactive; as if asleep; quiet; still.
Drydock	An area from which the water can be emptied, used for exposing the underwater portion of a ship for construction, inspection, repair, or hull maintenance.
Dye Penetrant	A liquid with low surface tension, containing a dye or florescent chemical; which when flowed over a metal surface, is used to determine the existence and extent of cracks and other discontinuities.
Elevation	The vertical distance above or below some established reference level. A drawing showing the vertical elements of a building, either exterior or interior.
End Bells	A hollow metal cylinder closed at one end and flared at the other; used to protect the operator and internal parts and to contain lubrication. A conical device that seals the top of a

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blast furnace or other mechanical device.

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Eroded	Worn away; decayed; eaten into; disintegrated; formed by wearing away gradually.
Erosion	The deterioration brought about by the abrasive action of fluids or solids in motion.
Eye Bolts	A bolt having its head in the form of a loop or an eye.
Fathometer	A depth by echo sounding recording instrument used to produce a horizontal profile of the elevations of the bottom of a body of water; often used in hydrographic surveys.
Fatigue	The tendency of a metal or other material to crack and fail under repeated applications of stress.
Fender	A device, especially of wood, rubber, or rope used to prevent damage to a vessel or shore facility by impact or abrasion.
Fender Piles	A pile, usually driven at an angle, on the perimeter of a pier or other shore structure designed to protect the structure to which it is adjacent.
Fire Curtain Wall	A transverse wall under a pier which extends from the underside of the deck to the low water line; designed to contain a fire.
Fittings	A pipe part, usually standardized, such as a bend, coupling, cross, elbow, reducer, tee, union, etc.; used for joining two or more sections of pipe together. The term usually is used in the plural. An accessory such as a bushing, coupling, locknut, or other part of an electric wiring system which is intended to perform a mechanical rather than an electrical function.
Flange	A projecting collar, edge, rib, rim, or ring on a pipe, shaft or the like. Also one of the principle longitudinal components of a beam or girder which resists tension or compression.
Flotation Tank	Any enclosed space or compartment which when emptied makes use of the ability or tendency of air to float or rise in liquid providing upward pressure on a floating object.
Floor Slabs	A concrete mat poured on subgrade, serving as a floor rather than as a structural member.
Footing	That portion of the foundation of a structure which transmits loads directly to the soil; used to spread the load over a greater area to prevent or reduce settling.

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Fouling	An accumulation of deposits, especially marine biological growth.
Foundation	Any part of a structure that serves to transmit the load to the earth or rock, usually below ground level; the entire masonry substructure.
Frayed	To make or become weakened or strained; worn; ragged; raveled by rubbing.
Freeboard	The additional height of a structure above high water level to prevent overflow. The distance between the water line and the deck.
Fungus	Any of a large group, including molds, mildews, mushrooms, rusts, and smuts, which are parasites on living organisms or feed upon dead organic material, lack chlorophyll, true roots, stems, leaves, and reproduce by means of spores.
Gallery	A horizontal or nearly horizontal, underground passage either natural or artificial. In a dry dock it runs around the perimeter at the top above the water line; it is open to the dock chamber and provided with a safety rail.It is used to carry pipes and serves as a place to make connections to process systems.
Galvanized Steel	Steel plated with zinc to act as a corrosion inhibitor.
Girders	A large or principal beam of steel, reinforced concrete, or timber; used to support concentrated loads at isolated points along its length.
Grade Line	A line usually marked with stakes or other monuments, each having an elevation referred to a common datum; by measurement or computed from such elevations and stakes, a grade is established between the end points.
Granite	An igneous rock having crystals or grains of visible size; consists mainly of quartz, feldspar, and mica or other colored minerals. In the building stone industry, a crystalline silicate rock having visible grains; this includes gneiss and igneous rocks that are not granite.
Grating	A framework of parallel or latticed bars set in a window, door, floor, etc.; design to keep out unwanted items but let air, light, and water, through.

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Gravel	A coarse granular aggregate, larger than sand; formed either naturally or by crushing rock; will pass a three inch sieve and be retained on a quarter inch sieve.
Graving Drydocks	A fixed basin usually of stone masonry, concrete, or piling cells adjacent to the water's edge. It can be closed off from the waterway by a movable watertight barrier (entrance caisson or flap gate). It can, therefore, be pumped dry, allowing a ship to settle down on blocking set on the dock floor.
Greenheart Timber	Any of various tropical trees whose wood is valued for its hardness and resistance to fungi and insects; used for shipbuilding, docks and marine planking.
Grid	A network of evenly spaced horizontal and vertical bars or lines, especially one for locating points when placed on a map, chart, or building plan. A framework of parallel bars; gridiron; grating. A metallic plate in a storage cell for conducting the electric current and supporting the active material.
Grinding	To crush into bits or fine particles between two hard surfaces; pulverize.
Groins	A narrow rubble-mound structure projecting out from the shoreline at right angles and straddling the tidal zone. These structures control the rate of shifting sand by influencing offshore currents and wave action in a manner such that erosion of the shoreline is prevented or minimized.
Harbor	A protected inlet, or branch of a sea; used as a shelter and anchorage for ships, especially one with port facilities.
Handrail	A narrow rail to be grasped by a person for support.
Half-cell Test	In electrochemical cells, the electrical potential developed by the overall cell reaction can be considered, for calculation purposes, as the sum of the potential developed at the anode and the potential developed at the cathode, each being a half-cell. This difference in potential can be detected by placing a copper/copper sulfate half-cell on the surface of the concrete and measuring the potential differences between the reinforcing steel and a wet sponge on the concrete surface. The reference cell connects the concrete surface to a high-impedance voltmeter, which is also connected electrically to the reinforcing steel mat.

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Housing	In a pump, motor, or fan the casing or enclosure which contains the parts of the piece and acts to protect the enclosed machinery.
Hydraulic	Operated or effected by the action of water or other fluid of low viscosity.
Hydrographic Survey	A survey made to determine the elevations of the floor of a body of water.
Hydrostatic Pressure	The pressure equivalent to that exerted on a surface by a column of water of a given height.
Impact	A striking together; violent contact; collision.
In-situ	In position; in its original place.
Jacketed	An outer covering or coating; the insulating casing on a pipe or boiler.
Jetted	A method of driving piles or well points into sand by using a jet (a strong, well-defined stream of compressible fluid, either liquid or gas, issuing from an orifice or nozzle or moving in a contracted duct) of water to break the soil.
Jetty	A structure (such as a mound or wall) located at the entrance to a harbor or in a river estuary; extending from the shore into deeper water to prevent the formation of sandbars and to direct and confine the flow of water due to currents and tides.
Keel	The principal bottom structural element of a ship extending along the centerline for the full length of the ship.
Keel Blocks	Are placed under the longitudinal centerline keel of the vessel. All keel blocks are interchangeable; therefore, each is designed for the maximum ship load likely to be imposed upon it at any location. Compression is the primary stress.
Lash	To fasten or tie with a rope.
Lateral Forces	The cause or agent that puts an object at rest into motion or alters the motion of a moving object in the direction of the side; on either side of the medial vertical plane.
Level	A horizontal line or plane; especially such a plane taken as a basis for the measure of elevation.

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Life Cycle	Under normal conditions, the expected life span based on proper installation and preventive maintenance.
Live Load	The moving or movable external load on a structure; includes the weight of furnishings, of the people, of equipment, etc. contained in a building, but does not include wind load.
Lineal Intervals	A space between two points on a line.
Lock-out	To make a valve or circuit inoperative by shutting out and putting padlocks or other restrictive devices on the unit and identifying the lock-out with a card or sign.
Marine Railway	A ramp extending into the water, with a mobile cradle that moves on rails, for hauling a ship out of or into the water.
Manhole	An access hole in a deck, floor, or street; connecting the surface to underground systems or equipment, usually covered with a cast iron or steel plate.
Mean Low Water	The average height of the low waters over a nineteen year period; as measured at a single point on the shoreline.
Members	One of a number of units which when assembled together becomes an integral part of the entire building or structure.
Misaligned	Not in a straight line, not in agreement, not parallel or on the same level.
Mobilization	To put into motion, to bring into readiness for immediate active service; to organize (people, resources, etc.) for active service or use.
Moles	A massive rubble-mound structure that extends outward from shore into the navigable water of a harbor. Generally, the level top is appreciable in area and contains paved roads, railroads and crane trackage. It may serve as a breakwater or pier.
Monolithic	Reinforced concrete, cast with no joints other than construction joints.
Mooring	Holding a ship in place by cables or chains to the shore or anchors to the seabed. The lines or cables by which this is done. A place where this can be done.

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Mortar	A mixture of cement or lime with sand and water, used between bricks or stones in building to fill voids and bond together the masonry.
Motor Shaft	A bar or cylinder supporting or transmitting motion to a mechanical part.
Mud-zone	The area that lies under the sea down to stable ground or bedrock. The result of erosion and decomposition; the material in this zone is viscous and unstable.
Operating Stems	The portion of a valve perpendicular to the body used to unite and integrate the wheel or handle and the closing mechanism of the valve inside the body.
Parallel	Extending in the same direction and at the same distance apart at every point, so as never to meet, as lines, planes, etc.
Parasite	A plant or animal that lives on or in an organism of another species from which it derives sustenance or protection without benefitting the host and usually doing harm.
Pier	A open- or closed-type structure usually extending perpendicularly from the shore into sheltered navigable water, designed for berthing, loading or unloading cargo, repair, fueling and general servicing of vessels. It normally provides berthing space on both sides for its entire length.
Pile Caps	A slab or connecting beam which covers the heads of a group of piles, tying them together so that the structural load is distributed and they act as a single unit.
Piles	A long, slender timber, steel or reinforced concrete structural element driven, jetted, or otherwise embedded into the ground to support a vertical load, to resist lateral forces or to resist water or earth pressure.
Pilot Lamps	A light which is associated with and indicative of the operation of a circuit, control, or device.
Pitting	The development of small cavities in a surface, owing to phenomena such as corrosion, cavitation, or (as in concrete) localized disintegration. The development of surface defects on a metal surface, e.g. small depressions, usually caused by electrochemical corrosion.

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Planking	A flooring surface or covering made of planks: (a long, wide, square-sawn piece of timber. Specifications vary but often the minimum width is eight inches and the minimum thickness is two to four inches).
Plumb	Exactly vertical.
Pneumatic	Pertaining to or operated by air or other gas.
Pontoon Tanks	Floating objects, as hollow cylinders, used as supports for a temporary bridge.
Pop-outs	A conical fragment that has broken out of the surface of the concrete leaving small holes. Generally a shattered aggregate particle will be found at the bottom of the hole, with a part of the fragment still adhering to the small end of the pop-out cone. Pop-outs are caused by reactive aggregates and high alkali cement. They are also caused by aggregates such as shale, which expand with moisture.
Potential Gradient Mapping	A plotting of points delineating the difference in the values of the voltage per unit length along a conductor or through a dielectric.
Pre-cast	A concrete member that is poured and cured in other than its final position.
Quaywalls	A heavy structural barrier of steel stone or wood, fronting on navigable water, and parallel to the shore; behind which earth fill is placed, built as a part of a waterfront structure. Its function is to act as a bulkhead as well as to provide for berthing of vessels or other service.
Ramp	A sloped surface connecting two or more planes at different levels.
Range	To vary between stated limits. To layout a length of chain in a straight line.
Rattling	A quick succession of sharp short sounds.
Recessed	Any shallow depression in a surface; an item which is placed in a ceiling or wall so the edge of the unit is flush with the surface.

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Riprap	Stones, boulders, or concrete armor units of miscellaneous size placed without order on the surface of an earthen embankment to act as protection against erosion.
Rivets	A short pin, of a malleable metal such as iron, steel, or copper, with a head at one end; used to unite two metal plates by passing it through a hole in both plates and then hammering down the point to form a second head.
Rot	Decomposition in wood by fungi and other microorganisms; reduces the strength, density, and hardness.
Rotary	Turning around a central point or axis, as a wheel; occurring around an axis.
Rotor	The rotating member of an electrical machine or device such as the rotating armature of a motor or generator or the rotating plates of a variable capacitor.
Rubble-mound	A type of construction using rough and uncut stones, irregularly shaped and of various sizes (ranging up to 1,000 cubic feet and up to 90 tons each) placed on the sea bottom to make breakwaters, groins, moles, and jetties.
Rungs	Any sturdy stick, bar, or rod, especially a rounded one, used as a crossbar or support; any of the crosspieces constituting the steps of a ladder.
Run-out Play	The measurement of wear or erosion of a bearing or shaft.
Sag	To sink, bend, or curve, especially in the middle, from weight or pressure. To hang down unevenly or loosely.
Sandbars	A ridge or narrow shoal of sand formed in a river or along a shore by the action of currents or tides. These can be hazards to navigation and are controlled by groins, breakwaters etc.
Scaling	The gradual and continuing loss of surface mortar and aggregate over an area; due to the failure of the cement paste caused by chemical attack or freeze/thaw cycles.
Schmidt Test Hammer	Utilizes a spring-loaded plunger that impacts the surface, causing the mechanism to rebound. The rebound is measured and compared to the initial extension of the spring, yielding a rebound number; also known as a Swiss hammer. Rebound can be affected by the angle of test, surface smoothness, type of aggregate, carbonation of concrete, and the moisture

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Scour	Removal of underwater material by waves and currents, especially at the base of a shore structure.
Scuppers	An opening in a deck used to provide means for rain or other water accumulated upon a surface to drain through it into the space beneath the structure.
Seals	A tight closure as against the passing of air and water, something that closes or fastens tightly or securely.
Seawall	A massive gravity-type structure built along and generally parallel to the shoreline. Placed out past the tidal zone; it is designed to protect the shore against erosion resulting from wave action.
Semi-permeable	A strata of earth or other type layer which allows a passage or penetration of water, but is not as porous as a permeable soil.
Settling	Cause to sink and become more dense and compact. To move downward; sink; especially gradually.
Sextant	A double reflecting optical instrument used in navigation for measuring angles, primarily altitudes of celestial bodies above the horizon.
Shackles	Any of several devices used in fastening or coupling.
Sheathing	The covering (usually wood boards, plywood or wallboards) placed over exterior studding or rafters of a building; provides a base for the application of wall or roof cladding.
Sheet Piling	A barrier or diaphragm formed of sheet piles: (a flat interlocking pile having its length considerably greater than its width) used to prevent the movement of soil, to stabilize foundations, to construct cofferdams, to prevent the percolation of water.
Shoals	A sand bar or piece of rising ground forming a shallow place that is a danger to navigation, especially one visible at low water.
Slope	Any inclined line, surface, position, etc. (slant) Deviation from the horizontal or vertical.
Sluice Gates	An artificial channel or passage for water, having a gate or valve at its head to regulate the flow, as in a canal or millstream.

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Sloughing	The slipping down of material from where it was placed, usually because of excess water; shedding; discarding; to separate from the surrounding area.
Sockets	A hollow piece or part into which something fits.
Soundings	Determining the depth of a body of water by an echo sounder or sounding line.
Spalling	A roughly circular or oval depression in the concrete. Spalls result from the separation and removal of a portion of the surface concrete, revealing a fracture roughly parallel to the surface. Spalls can be caused by corroding reinforcement steel and friction from thermal movement; reinforcing steel is often exposed.
Splash Zone	The region immediately above the high tide levels; the splash action of waves keeps this area continually wetted by highly oxygenated seawater; materials suffer accelerated rates of corrosion in this zone.
Spline	A flat key or strip that fits into a groove or slot between parts. The groove or slot into which it fits.
Stanchions	An upright bar, beam, or post used as a support.
Stator	A fixed part forming the pivot or housing for a revolving part (rotor), as in a motor, dynamo.
Struts	A brace or any piece of a frame which resists thrusts in the direction of its own length; may be upright, diagonal, or horizontal.
Substrate	A part, substance, element, etc. which lies beneath and supports another; foundation; any basis or foundation.
Suction	The production of a vacuum or partial vacuum in a cavity or over a surface so that the external atmospheric pressure forces the surrounding fluid into the cavity or causes something to adhere to the surface.
Tautness	Tightly stretched, as a rope. Showing strain; tense.
Tide	The alternate rise and fall of the surface of the oceans and seas, and the bays, rivers, etc. connected with them. Caused by the attraction of the moon and sun; it occurs twice in each period of twenty-four hours and fifty minutes.

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Toe	A projection from the foot or foot piece of any object or construction to give it broader bearing and greater stability. That part of a base of a concrete retaining wall which projects in front of the face of the wall, away from the retained material.
Transit	A surveying instrument used for the measurement and laying out of horizontal and vertical angles, distances, directions, and differences in elevation; a type of theodolite having an alidade with a telescope which can be reversed in direction.
Trash Racks	A screen placed athwart openings, intakes, channels or tunnels to prevent intake of solid matter. Must be removable for maintenance and replacement.
Treated Wood	Structural timber treated with preservatives to protect it from degradation by decay, fungi, insects, and marine borers. Preservatives are applied by non-pressure processes that provide superficial protection; and by pressure processes that force chemicals into the wood.
Trusses	A structure composed of a combination of members, usually in some triangular arrangement so as to constitute a rigid framework.
Tunnel	There are two types of tunnels used in drydocks, one type is for flooding and drainage of the dock. The other type is a pipe tunnel for carrying electrical conduit as well as steam or other fluids, the pipe tunnel is found directly behind the gallery.
Turnbuckless	A metal sleeve with opposite internal threads at each end for the threaded ends of two rods or for ringbolts, forming a coupling that can be turned to tighten or loosen the rods or wires attached to the ringbolts.
Ultrasonic Pulse Velocity Test	An ultrasonic detector is used either in scanning (non-contact) or in contact mode. The pulse velocity test uses the contact mode. A metal probe (transducer) supplied with the detector is stimulated by ultrasound and transmits the waves, when touched against equipment surfaces, to another detector. The velocity of this ultrasonic pulse is measured; the faster the pulse the more dense the material tested. The test can also detect and evaluate cracks, voids, delamination and other defects.
Underpinning	A supporting structure or foundation, especially one beneath a wall. A support or prop.

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Vertical	Perpendicular, or at a right angle to the plane of the horizon; upright; straight up and down.
Vibration	Rapid, periodic, to-and-fro motion or oscillation of an elastic body or the particles of a fluid when displaced from the rest position or position of equilibrium, as in transmitting sound.
Voltage	Electromagnetic force, or difference in electrical potential, expressed in volts.
Wales	A horizontal timber or beam used to brace or support an upright member, as sheeting, form work for concrete, etc.
Water Blaster	A system designed for the cleaning of hard substrates; uses pressurized water to impact and remove scale, chips, debris and dirt. With high pressure units blasting can be used for paint removal and profiling.
Weep Holes	Opening provided in a wall or bulkhead to facilitate the drainage of water. It usually serves to reduce hydrostatic pressure behind the structure.
Weld	To unite metals by heating them to suitable temperatures, with or without the application of pressure, and with or without the use of filler metal.
Wharf	An open-type marginal platform structure, usually parallel to the shoreline, that is used primarily for berthing of vessels. It is usually connected to the shore at more than one point but may also have continuous access along the shore. It ordinarily provides berthing along the outboard face.
Winch (Windlass)	An engine fitted with a rotating drum for hauling ropes or cables. Some are fitted with multiple drums, a gypsy head for hauling ropes or a wildcat for hauling chains.
Wire Rope Cable	A tension member comprised of numerous strands of wire twisted so as to form a rope.

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LIFE CYCLES

21 WATERFRONT

21.01 DOLPHINS

Dolphins, treated piles	50 YRS
Dolphins, untreated piles	30 YRS

Source:
VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

21.02 WHARVES

Wharf	100 YRS

Source:
VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

21.03 PIERS

Pier	75 YRS

Source:
VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

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21.04 GRAVING DRYDOCKS

Drydock Closure	180 YRS
Drydock Deck Surface	80 YRS
Coping Surfaces	35 YRS
Steel Caissons	30 YRS
Sluice Gates	30 YRS
Fenders, Bearing Blocks	15 YRS
Caisson Seats	15 YRS
Concrete Stairs	80 YRS
Steel Stairs/Ladders	50 YRS
Steel Catwalks	50 YRS
Keel and Bildge Blocks	15 YRS
Capstans	30 YRS
Marine Hardware	80 YRS
Pumps	15 YRS
Motors	15 YRS
Motor Controls	15 YRS
Piping and Fittings	30 YRS
Valves	15 YRS

Sources:

1. NAVFAC DM 29.1, Graving Drydocks
2. VSE Corporation Memorandum, Response to NAVFAC Request for Data from the Underwater Inspection Base, 12/1/92
3. NAVFAC DM 29.3, Drydocking Facilities Characteristics
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC 1988
5. NAVFAC DM 29.2, Marine Railways

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21.05 MARINE RAILWAYS

Reinforced Concrete Groundway	80 YRS
Wood Chain Paths and Guides	30 YRS
Steel Chain Path Wearing Plate	10 YRS
Steel Cradle Tracks	100 YRS
Wood Track Supports	30 YRS
Concrete Track Supports	80 YRS
Steel Track Supports	50 YRS
Steel Frame and Deck Cradles	50 YRS
Steel Frame, Wood Deck Cradles	50 YRS
Wood Frame and Deck Cradles	30 YRS
Cradle Wheels	25 YRS
Cradle Roller Trains	33 YRS
Chain Pulls	50 YRS
Keel and Bilge Blocks	15 YRS
Boot Jacks	30 YRS
Docking Winch Assembly	30 YRS
Steel Walkway Framing	50 YRS
Wood Walkway Framing	30 YRS
Wood Walkway Decking	30 YRS
Steel Walkway Railing, Ladders and Draft Gauges	50 YRS
Wood Walkway Railing, Ladders and Draft Gauges	30 YRS
Wood, Rubber, Vinyl, Rope Fenders	15 YRS
Walkway Fittings	30 YRS
Inhaul and Outhaul Chains	50 YRS
Inhaul and Outhaul Cables	50 YRS
Inhaul and Outhaul Chain/Cable Sheaves and Shackles	50 YRS
Hoist Assembly	30 YRS

Sources:

1. NAVFAC DM-29.2, Marine Railways
2. VSE Corporation Memorandum, Response to NAVFAC Request for Data from the Underwater Inspection Base, 12/1/92
3. Design and Construction of Ports and Marine Structures, McGraw Hill, 1961
4. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

21.06 QUAYWALLS

Quaywall 100 YRS

Source:

VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

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21.07 JETTIES

Steel sheet piling, coated	30 YRS
Steel sheet piling, treated	30 YRS

Source:
Design and Construction of Ports and Marine Structures, Alonzo DeF Quinn, McGraw-Hill, 1961

21.08 BREAKWATER

Breakwater	75 YRS

Source: VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

21.09 GROINS

Wood piles, treated	50 YRS
Wood piles, untreated	30 YRS
Timber sheet pilings, coated	30 YRS

Source:
Design and Construction of Ports and Marine Structures, Alonzo DeF Quinn, McGraw-Hill, 1961

21.10 SEAWALLS

Seawall	100 YRS

Source:
VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

APPENDIX C

21.11 WATERFRONT SPECIALTIES

Piles - Treated Wood	50 YRS
Piles - Untreated Wood	30 YRS
Piles - Concrete	40 YRS
Piles - Steel	25 YRS
Fixed Hung Fender - Treated Wood	50 YRS
Fixed Hung Fender - Untreated Wood	30 YRS
Fixed Directly Mounted Fender Unit	15 YRS
Floating Fender - Foam-Filled	15 YRS
Floating Fender - Pneumatic	15 YRS
Floating Log Camels - Wood	15 YRS
Floating Crib Camels and Separators	15 YRS
Floating Camels and Separators - Metal Framed	25 YRS

Sources:

VSE Corporation memo to CHESNAVFACENGCOM of Dec. 1, 1992

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988